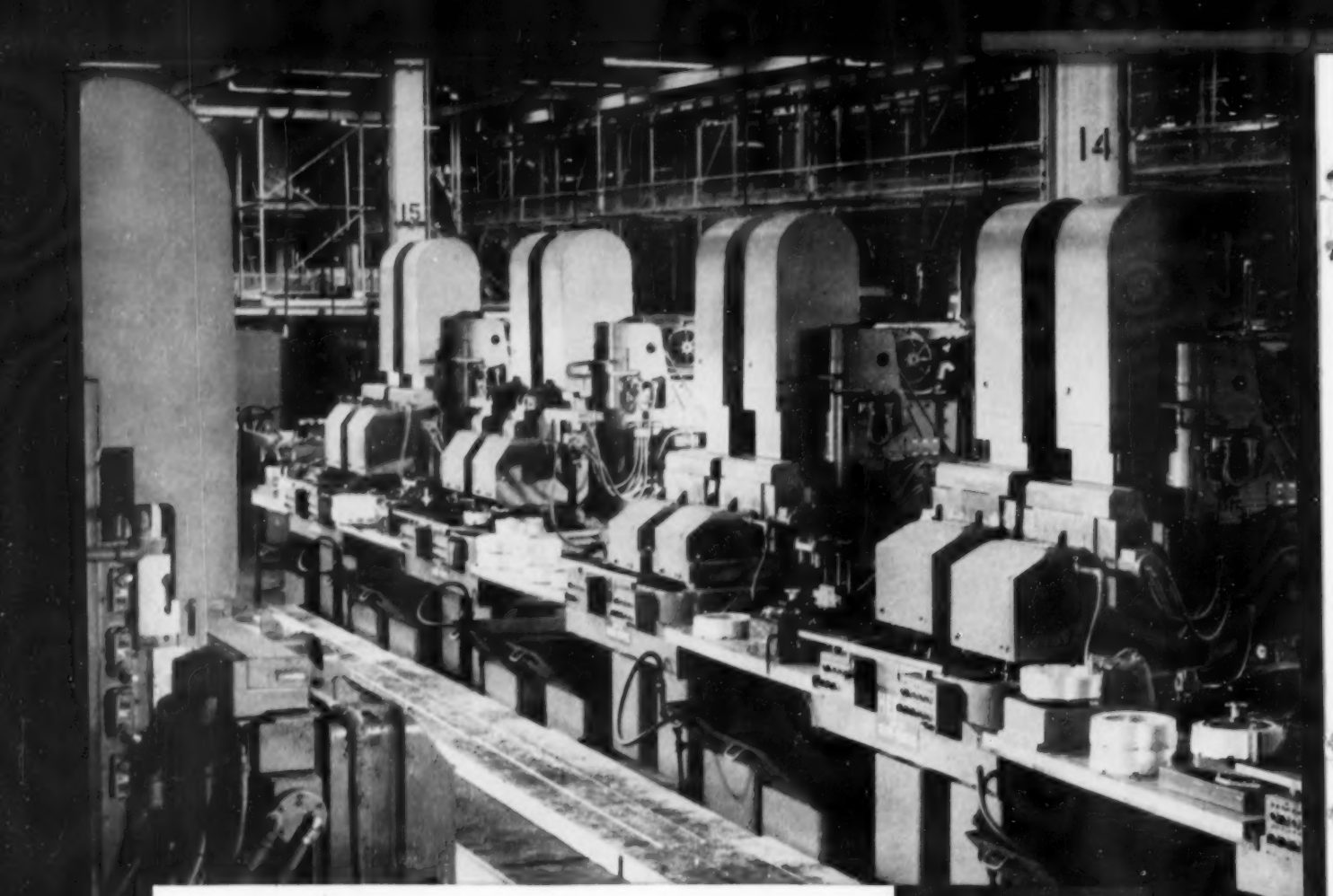
the TOOL ENGINEER

APRIL 1957

barrel finishing

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



Here's how

VERTICAL Bore-Matics

can save time and money on many precision-finishing jobs

LESS FLOOR SPACE These compact Vertical Bore-Matics save precious floor space, make use of more available up and down areas, permit operator to handle more than one machine.

EASIER LOADING Parts located down and onto the fixture, not up and into the workholding device. All stations are *front* stations – less reach and stretch.

IMPROVED CHIP AND COOLANT CONTROL Vertical units lend themselves naturally to gravity control of chips and coolant by means of simple, effective guarding.

CONTINUOUS PRODUCTION Independent operation of each station provides maximum opportunity to keep stations cycling continuously except for loading and unloading time.

THESE are just a few of the reasons why many types of work can be handled more efficiently and economically on a Heald Vertical Bore-Matic than on any other type of precision-finishing machine. For further details, send for Bulletin 2-352-1, Issue 1.

Ten Model 352 VERTICAL BORE-MATICS precision finish 5 different automatic transmission parts

Shown above is an installation of Heald Vertical Bore-Matics in a large automotive manufacturing plant. These space-saving machines are used for high-production Borizing of the following automatic transmission parts:

- Disc and Hub Assemblies
- First Turbine Converters
- Convertor Pump Housings
- Turbine and Shaft Assemblies
- Second Turbine Convertors

Versatility of cycling and ease of tool changing makes these units readily adaptable to future job changeovers.

IT PAYS TO COME TO HEALD

HEALD

THE **HEALD** MACHINE COMPANY

Worcester 6, Massachusetts

Subsidiary of The Cincinnati Milling Machine Co.

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

COVER: Finishing barrels are precision tools for deflashing, deburring, descaling, generating radii and improving surface finish. Successful finishing is dependent on manipulating many variables to obtain the results desired. These variables are discussed in an article beginning on page 109.

The Tool Engineer

Volume XXXVIII, No. 4 April 1957

TECHNICAL ARTICLES

The New Broom	*By H. C. McMillen*	69
How To Produce More Ideas	*By James A. Houle*	71
Gadgets		75
Simplified Assembly Tooling	*By R. A. Wagner*	78
Clamped vs. Brazed Carbides	*By L. T. Parker and M. T. Douglas*	85
Designed for Production		89
Residual Machining Stresses	*By E. K. Henriksen*	92
Finishes Produced by Ceramics and Carbides	*By M. C. Shaw and P. A. Smith*	97
Weldable, Machinable and Heat-Treatable Carbides	*By J. L. Ellis*	103
Tools at Work		106
Fundamentals of Barrel Finishing (Part 1)	*By T. W. Black*	109
Safe Operation of Abrasive Wheels (Reference Sheet)		119

ASTE NEWS

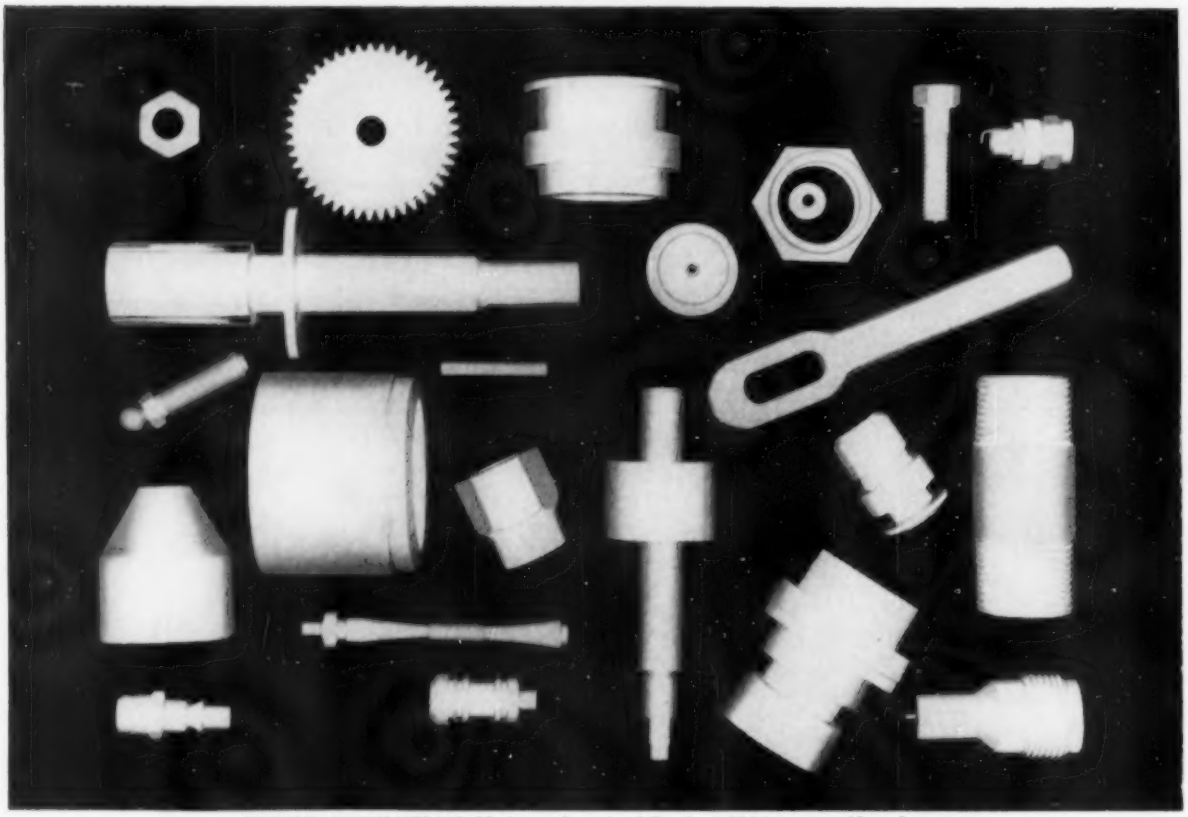
Featured This Month	124
ASTE Honor Awards	125
Houston Dispatch	135
1957 Annual Report	137
Birmingham Chapter Chartered	145
April On-Campus Conferences	146

DEPARTMENTS

Abstracts of Foreign Literature	215	Tech Digests	219
Field Notes	199	Technical Shorts	211
Good Reading	206	Tools of Today	161
Letter from the Editor	3	Trade Literature	212
Men at Work	209	Who's Meeting—and Where	204
Progress in Production	157	Advertisers' Index	322

PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and the *Industrial Arts Index*



ONE OIL, MANY METALS. Moderately priced Sunicut 5534 gave uniformly excellent results in the machining of this wide variety of top-quality steel parts.

Designed especially for job shops...

NEW SUNICUT 5534 CAN BE USED ON A WIDE VARIETY OF STEELS

SUNICUT® 5534 ends your search for a single cutting oil that can assure quality machining of a wide variety of ferrous metals...ranging from B1112 to 4130 and including free-machining stainless steels.

A non-emulsifying, transparent cutting oil, Sunicut 5534 can speed production of general screw machine and turret lathe work. It gives excellent finish in tapping, drilling, threading, and light stamping operations and can be used on many special jobs run at both high and low speeds.

Try moderately-priced Sunicut 5534. It can save you money by reducing your cutting oil inventories and oil change time. It can boost your production and profits.

For detailed information, prices and delivery data about this new, versatile cutting oil, call your Sun representative today. Or write directly to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. TE-4.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY Philadelphia 3, Pa.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

Harry E. Conrad
Executive Secretary
Allan Ray Putnam
Publishing Manager

Editorial

John W. Greve
Editor
Robert A. Wason
Associate Editor
Ralph H. Eshelman
Associate Editor
Theodore W. Black
Associate Editor
Arthur Colton
Assistant Editor
Dorothy J. Taylor
Assistant Editor
Janet B. Lofting
News Editor
Suzanne Olson
Assistant News Editor
Michael Babala
Art Editor
F. Latitia Pierce
Assistant Art Editor

Business

Michael Jakesy
Business Manager
Clarence T. Etter
Advertising Manager
Austin G. Cragg
Eastern Advertising Mgr.
400 Madison Ave.
New York 17, N. Y.
Francis Baldwin
Middle Atlantic Adv. Mgr.
400 Madison Ave.
New York 17, N. Y.
Richard E. Cleary
Ohio Advertising Mgr.
15515 Detroit Ave.
Cleveland 7, Ohio
R. Alan Cobleigh
Michigan Advertising Mgr.
10700 Puritan Ave.
Detroit 38, Mich.
Stanley F. Girard
Western Advertising Mgr.
612 North Michigan Ave.
Chicago 11, Ill.
Robert E. Ahrensdorf
Pacific Coast Adv. Mgr.
5720 Wilshire Blvd.
Los Angeles 36, Calif.
Fay H. LaRoue
Circulation Manager

THE TOOL ENGINEER
Editorial & Business Offices
10700 Puritan Ave.
Detroit 38, Mich.

Publication Office:
239 E. Chicago St.
Milwaukee, Wis.

THE TOOL ENGINEER is published monthly in the interest of members of the American Society of Tool Engineers. Entered as second class matter. November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription: members $2.00; nonmembers, $6.00; Canada, $6.50, and all other countries, $8.00. Copyright 1957, American Society of Tool Engineers.

The Tool Engineer

A Time For Growing

Most people follow the changing seasons with more than casual interest as they grow older. No longer does each new season offer a whole new panorama of interesting activities. Instead, weather becomes more of a nuisance with its deep snows, sticky mud, heat waves and high winds. They may not realize it, but many people follow cycles that are closely tied to the weather.

Winter is a time for existing, for making do with conditions as they are. Summer is a time for loafing, for looking to vacation and no professional problems. Fall is a time for making plans, mainly to get through the winter. But spring, spring is a time for growing. Nature is casting off a somber winter mantel and is making a new start. People in general and tool engineers in particular can also make a new start in the spring.

New ideas are traded at many technical society meetings and expositions. Manufacturers of tools and components usually introduce new lines and new products in the spring. Opportunities are all around for personal growth in the spring, and a new crop of problems is crying for solution.

This issue of THE TOOL ENGINEER has been designed to forestall spring fever. It is packed with new ideas that will help in solving the new problems; especially since most of these problems concern compressing time, reducing costs and increasing quality. There is an article that helps to point the way when faced with a decision to select a standard machine or ask for a special. Other articles summarize some of the rapid progress being made in the fields of ceramic and plastic tooling.

A staff report is included that shows how to apply barrel finishing methods where the process is unfamiliar. Still another article describes a specific approach to automatic assembly, the site of future automation "miracles". These are in addition to outstanding articles on more standard subjects and the regular monthly features.

If these ideas can but fall on fertile minds, it will indeed be a time for growing.

Robert A. Wason
ASSOCIATE EDITOR

NOW! Use ONLY ONE Setting Master to set Dial Bore Gages . . .

STANDARD *ELIMINATES COSTLY RING MASTERS AND PLATE SET-UPS...*

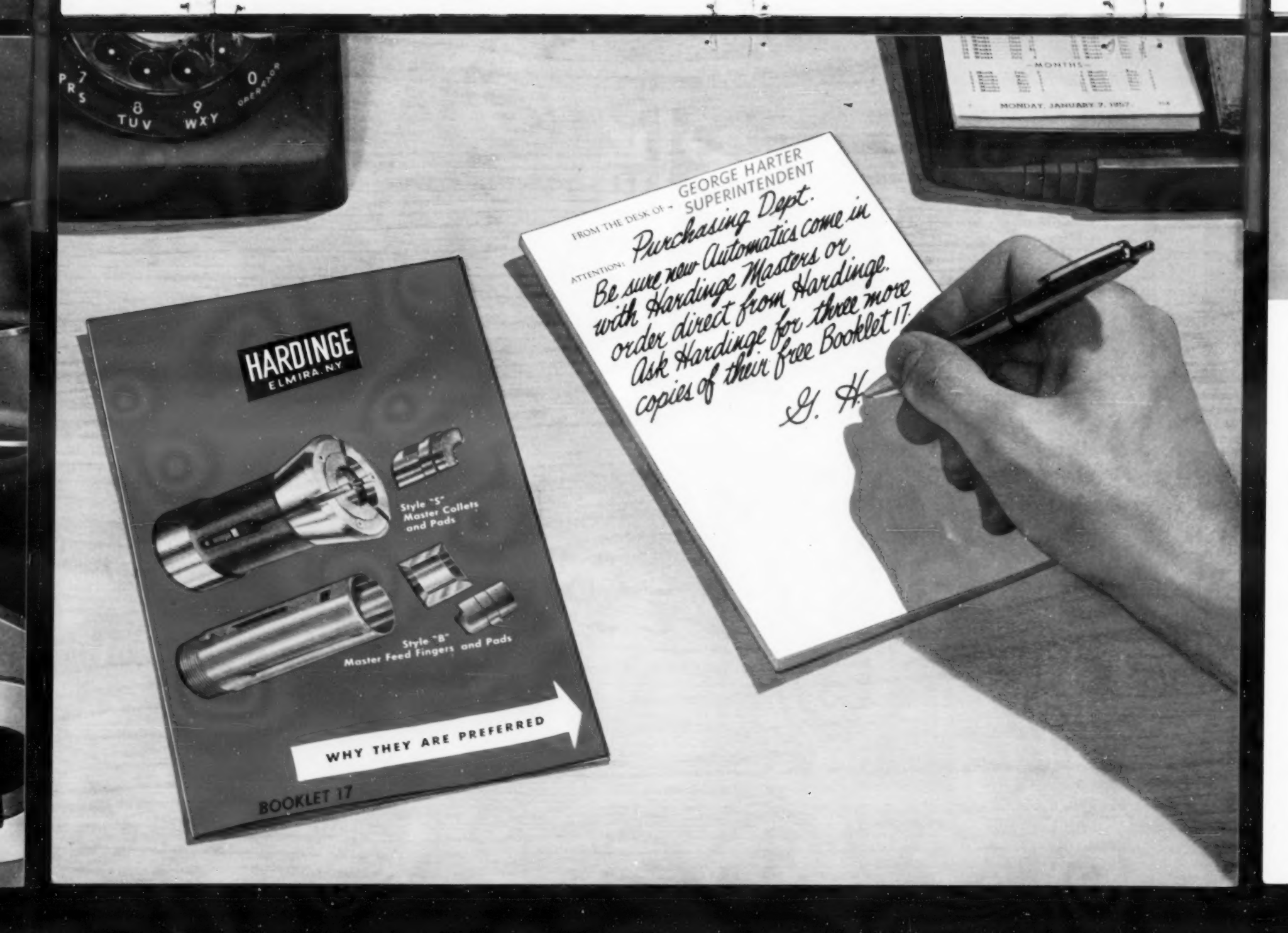
1. Outmodes necessity of stocking a master ring gage for every sized hole.
2. *Only one* Setting Master needed. Two models ranging from 0 to 7″ and from 0 to 14″.
3. Can be set to **XX** accuracy in less than 5 minutes.
4. Can be used vertically or horizontally.
5. Portable and light in weight.
6. Provides an ideal partner for Standard Dial Bore Gages — but can be used to set any other make.
7. Costs no more than 2 ring masters.

Write for catalog — or, better still, talk to your Man-from-Standard.

STANDARD Gage Company, Inc.

®SINCE 1925 61 Parker Avenue • Poughkeepsie, New York

A COMPLETE LINE OF GAGES . . . INDICATING, FIXED AND ADJUSTABLE LIMIT TYPES


HARDINGE
ELMIRA, N.Y.
Style "S" Master Collets and Pads
Style "B" Master Feed Fingers and Pads
WHY THEY ARE PREFERRED
BOOKLET 17
FROM THE DESK OF → GEORGE HARTER SUPERINTENDENT
ATTENTION: Purchasing Dept.
Be sure new Automatics come in with Hardinge Masters or order direct from Hardinge. Ask Hardinge for three more copies of their free Booklet 17.
G. H.
MONTHS
MONDAY, JANUARY 7, 1957

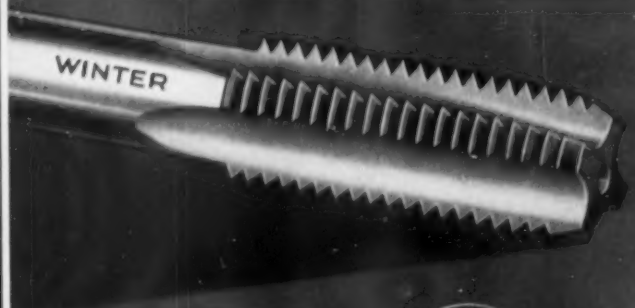
UNIFORMITY OF FLUTE CONTOURS
is one of the four essentials in Balanced Action performance—exclusive with Winter Taps.

Designed and built for men who know tapping costs:

BALANCED ACTION TAPS BY WINTER

The Winter Tap user has learned to consider only one cost: the *cost-per-hole*, shown by his records of accurate holes and long life.

CALL YOUR WINTER DISTRIBUTOR



EXACT FLUTE SPACING

WINTER

WINTER BROTHERS COMPANY
Rochester, Michigan, U.S.A.
Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.

PRECISION CHIP DRIVE CONTOURS

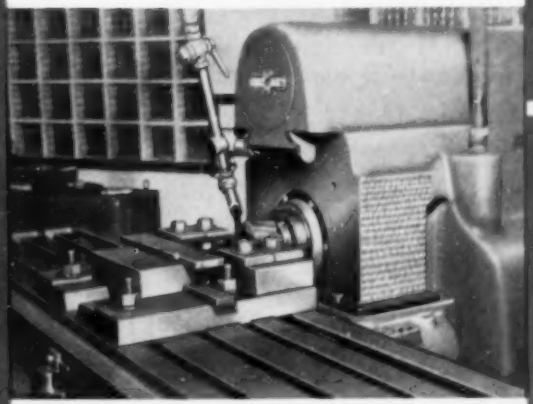
ACCURATE AND CONCENTRIC CHAMFERS

NATIONAL
TWIST DRILL
& TOOL
ROCHESTER, MICH., U.S.A.

Lowering the cost of metal cutting through laboratory research...

is a continuing process at National's Rochester plant. Many of the findings are already evident in the improved National tools of today; more can be expected in National's tools of tomorrow.

CALL YOUR
NATIONAL DISTRIBUTOR



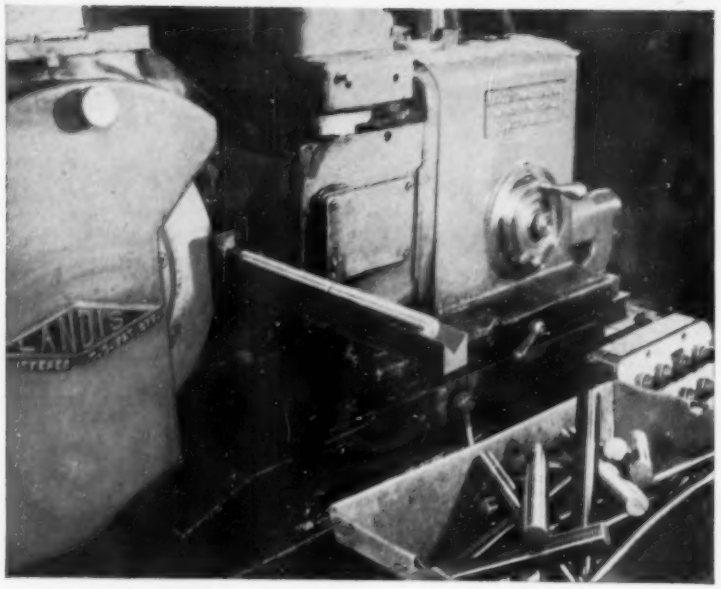
The search that never ends for better cutting methods... test milling of high tensile strength steel.

National

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles

TWIST DRILLS • REAMERS • COUNTERBORES • MILLING CUTTERS • END MILLS • HOBS • CARBIDE AND SPECIAL TOOLS



Threads 7¼" per Minute by CONTINUOUS GRINDING

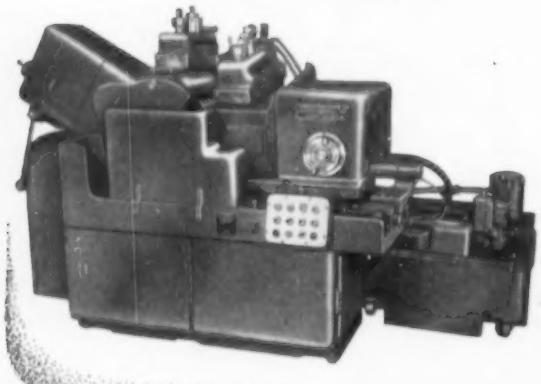
LANDIS Centerless Thread Grinders are being used at the Kilbourn Engineering Company in Milwaukee, Wisconsin, to produce continuous threaded studs for high-pressure high-temperature service.

Studs ranging from ⅝" to 1⅜" in diameter are threaded from blanks of SAE 4140 steel heat-treated to a 260-320 Brinell hardness. In the operations illustrated, 1⅛" 8 pitch UN threads must be generated 10" long to a Class 7 fit to meet ASA standards (Manual B1.4). These threads are produced with LANDIS #1 Centerless Thread Grinders by continuous thru-feed grinding at the rate of 7¼ linear inches per minute, *or better*. The excellent quality and smooth finish of the ground thread has reduced final assembly time and minimized galling.

Centerless Thread Grinders, manufactured exclusively by LANDIS, are designed for the high-speed threading of a wide variety of workpieces from 1/16" to 4¾" in diameter. Blanks having one or more diameters, requiring threads on the outer diameter, can be threaded automatically by the thru-feed process used here.

Centerless Thread Grinding, by utilizing the "up-grinding" technique, is also well-adapted for threading workpieces of high hardness and coarse pitch. This process allows up to 30% higher work surface speeds, and often eliminates secondary threading passes required by other methods.

For further information, send specifications and ask for Bulletin E-97.



LANDIS

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA • U.S.A.

390

now, in air tools, too,

if it's Remington, it's right!

featherweight
midget collet die
grinder

works in
any place your
hand can reach!

The famous PG-K-1030L Die Grinder has 7 great features that make it right for you!

- Weighs just 12 ounces! 4 5/8" long. Only 5/8" from side to center of spindle
- 30,000 RPM. Powerful 4-bladed motor—not a turbine—holds speed under load
- Air exhaust to front of tool keeps work clean
- Erickson precision collet chuck—1/4" collet is standard. 3/64" to 7/32" collet furnished at no extra cost if specified
- No high pitched whine—exhaust muffled by patented noise silencer
- Chuck guard allows finger-lip control
- Choice of lever or locking-button throttle

Model PG-K-1030L *Midget Collet Die Grinder for use with mounted wheels, points and burrs. Complete with wrench set, collet guard, 8' length 1/4" leader hose.*

Remington

Mall® **MALL TOOL COMPANY**
Division of Remington Arms Company, Inc.
25000 S. Western Avenue • Park Forest, Illinois

Electric Impact Wrenches...
"The Maintenance Handyman"

Super-versatile Flexible
Shaft Grinders

Specifications subject to change without notice

You boost production, cut costs on close, precision jobs...and with less worker fatigue in the bargain!

That's what plants all over the country are doing with this terrific little performer by Remington—the newest name in power tools and famous for 141 years for quality in sporting firearms and ammunition.

The PG-K-1030L is typical of our complete line of high efficiency air tools built for any power tool application. Let us tell you about them.

MALL TOOL COMPANY
Division of Remington Arms Company, Inc., Dept. 041
25000 S. Western Avenue • Park Forest, Illinois
Please send free catalog on Air Tools.

NAME _____

STREET _____

CITY _____ ZONE _____ STATE _____

compare with the standard

...in high speed steels the standard's **REX**

Ever since grandad's day, Crucible's REX® high speed steel has been *the standard by which all other high speed steels are compared.* And now the quality and uniformity of REX are even *better*, thanks to improved manufacturing techniques at Crucible.

Don't take our word for it. Prove for yourself how REX leads in structure, uniformity, response to heat treatment, and fine tool performance.

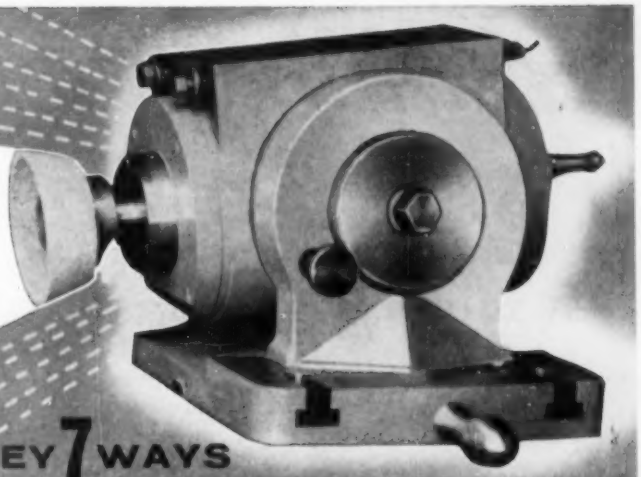
Ask for REX at your nearby Crucible warehouse – or order it through prompt mill shipments. And, for a list of available data on all Crucible special purpose steels, write now for a free copy of the "Crucible Publication Catalog". *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

HERE'S AN

ANGLE

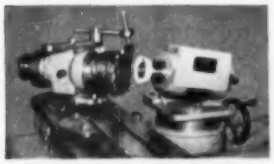


THAT SAVES YOU MONEY 7 WAYS
ON ALL YOUR TOOL AND CUTTER GRINDING

Specify this

POPE

SUPER PRECISION, 1 HP, 3600 RPM MOTORIZED TOOL AND CUTTER GRINDER CLEARANCE ANGLE SWIVELLING HEAD WITH ANGULAR ADJUSTMENT IN A VERTICAL PLANE



and get these seven savings:

1. Strong, long lasting tool cutting edges because cup wheel cutter grinding can be used for practically all clearance angles.
2. Tooth rest stays on the center line of the cutter for practically all grinding on centers or in the work head.
3. A single set-up grinds most cutters and reamers all over, using the swivelling table and Pope tilting head.
4. No more mistakes on clearance angles. They read directly in degrees from the scale provided on the head.
5. No more trouble or time wasted getting the right clearance angle on the tough ones such as slab mills, **taper reamers,** angular cutters and form tools.
6. No more heat checking of cutters. One safe speed — 3600 RPM — for all wheels generally used on cutter grinders.
7. Quick, easy adjustment saves you time and money every time you grind a tool.

Ask us to send you complete specifications including price and delivery.

No. 118

POPE® ENGINEERS AND BUILDS STANDARD AND SPECIAL PRECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

Established 1920

Lightning fast speed change

a money making virtue!

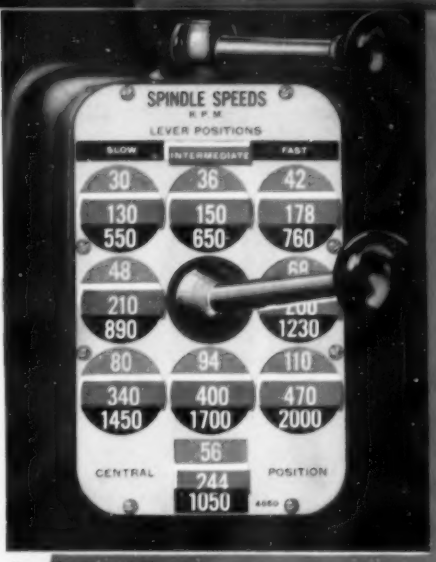
This time saving feature of "AMERICAN" Pacemaker Lathes appeals strongly to operators who acclaim it a real money maker for them.

The speed plate is direct reading and shows at a glance the available spindle speeds and how to secure them. Operators can't go wrong. So fast, so easy to read and so simple that they do not hesitate to make speed changes to secure correct cutting speeds.

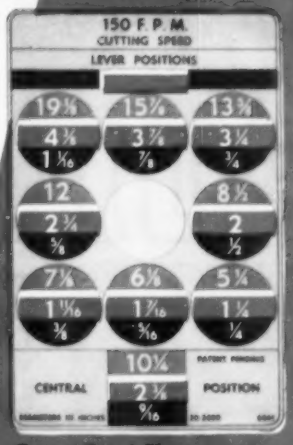
In addition, cutting speed snap-on plates are available indicating the lever positions for cutting various work diameters at the selected feet per minute cutting speed. These plates may be quickly applied and changed for the desired cutting speed.

No system for securing cutting speeds could be simpler, faster or less expensive in first cost and maintenance.

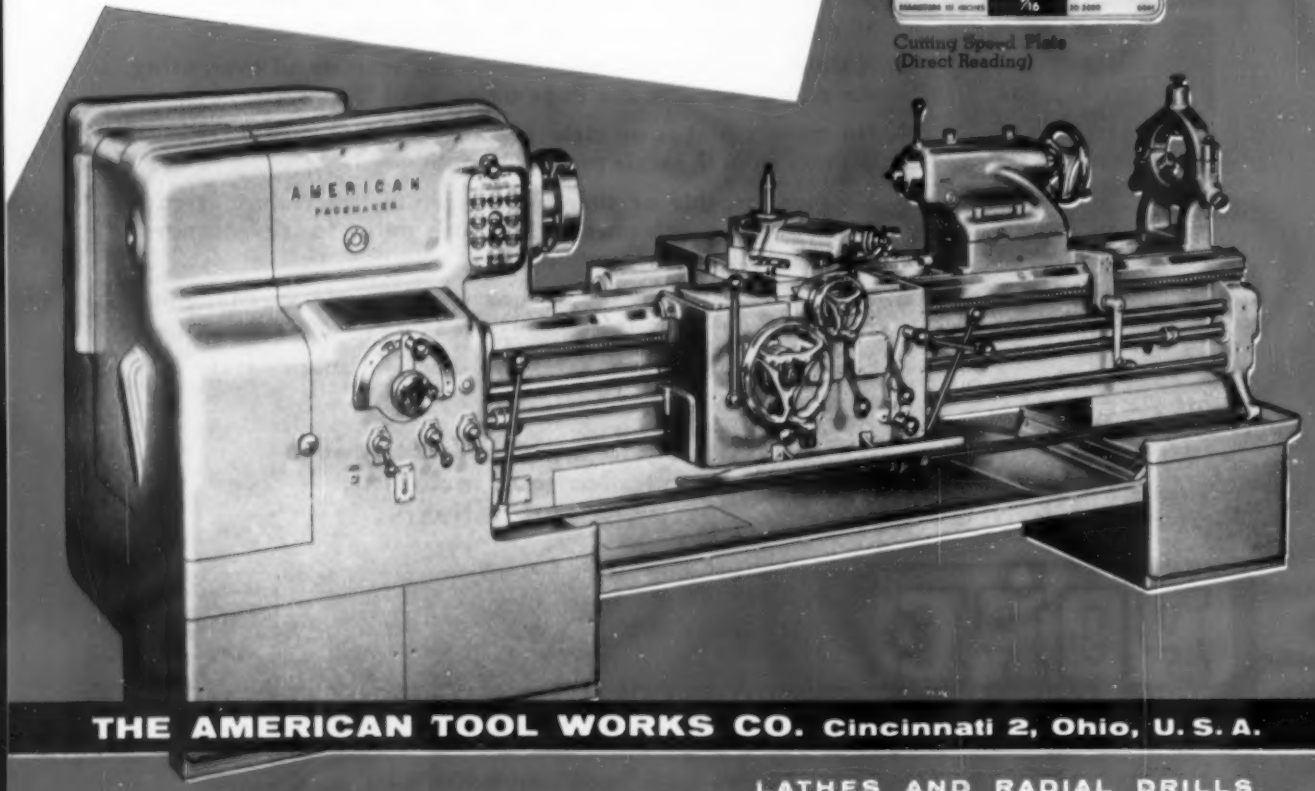
- *These and other fine features of the "AMERICAN" DeLuxe Model Pacemaker are illustrated and described by Bulletin No. 116.*



Spindle Speed Plate (Direct Reading)



Cutting Speed Plate (Direct Reading)



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

THE R and L TAP AND DIE HOLDER

CAN BE 6 TOOLS IN ONE!

Figure 1.
Ready to start threading operation, clutch slightly engaged at C.

Figure 2.
Instantly engaged to full contact between A and C as soon as tap or die engages work.

Figure 3
Fully released showing ample clearance between contact points of clutch preventing re-engagement or hammering of clutch points in case turret advances slightly after clutch releases.

It will be good news to many to learn that R and L has adapters for ACORN DIES and BUTTON DIES which are precision made to fit the R and L TAP AND DIE HOLDERS.

As you can see from the specifications and prices below, for a comparatively small investment an R and L TAP AND DIE HOLDER can truly become 6 tools in 1 . . . A Tap and Die Holder . . . and Acorn Die Holder . . . and a Button Die Holder . . . *For right and left hand threading!*

LEST YOU FORGET . . .

. . . The R and L TAP AND DIE HOLDER has an entirely new releasing mechanism, and can readily be changed for right or left hand threading. No spring plungers to wear or break. No small screws to work loose.

R and L TOOLS
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

OTHER FAMOUS R and L TOOLS:
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

TE-4

R and L TOOLS
1825 BRISTOL ST., PHILADELPHIA 40, PA.

☐ Please send me your new catalog
☐ Please arrange for no-obligation demonstration of R and L TOOLS

NAME .....
COMPANY .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

PRECISION REQUIRES SPECIAL

and Gets it with FEDERAL

OVER 12 TYPES of HOLE GAGES in all sizes

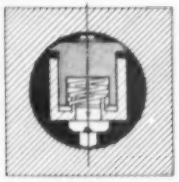
If you are not kidding yourself about Precision you know you have to gage a dimension a certain way if you want an accurate measurement.

That's why good gage users know that just *any* gage is *not* good enough. And that is why Federal makes so many different types of gages of the same general kind.

There are all degrees of accuracy required and

Whatever You Need in Gages

Ask FEDERAL *First*



Model 1250 Series
Positive Centralization
Set directly to Gage Blocks or Micrometers 4 sizes cover all diameters

Model 149P
I.D. Caliper Gage
(also Model 49 O.D. available) Stock and Special Models of All Shapes

Many Other Types.

Send for Catalog.
Illustrates the most extensive line available.

Model 1203
.122"-.250" Diameters
Model 1204
.250"-.506" Diameters

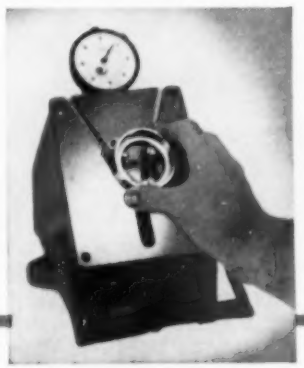
Model 1201 Series

Model 1242 Series
(Two-contact)
Model 1243 Series
(Three-contact)

Model 165 Series
Single Purpose Plug Type

Model 88 Series
Shallow Hole, Bore or Shoulder I.D. O.D. Diam. Adjustable and Single Dimension Models

Model 36 Series
Bench Type Hole and Outside Diameter Gages



Gages Can Be Modified Specially to Suit

TREATMENT

DIAL GAGES

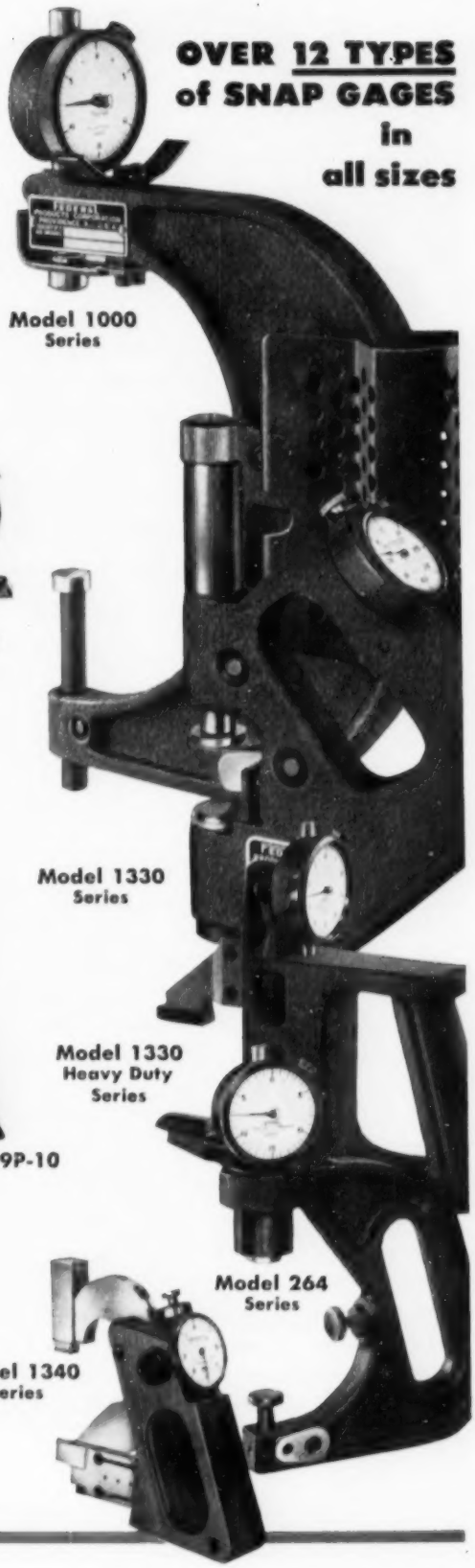
Federal takes the care to obtain that accuracy.

And some need more gaging pressure, and some less, and some need narrow anvils and some need wide anvils. Some want to gage just a hole diameter and some want to know if it's round or if it tapers.

It's easy to find the gage you need to check a dimension the right way — get in touch with us. Do it now.

Federal Products Corporation
7194 Eddy Street **Providence 1, R. I.**

OVER 12 TYPES of SNAP GAGES in all sizes



Model 1000 Series

Model 75 Series

Model 65 Series

Model 75P-10 Adjustable

Model 1330 Series

Model 1330 Heavy Duty Series

Model 264 Series

Model 1340 Series

DEPTH GAGES

All types — knife edge, long range, special anvils and special types.

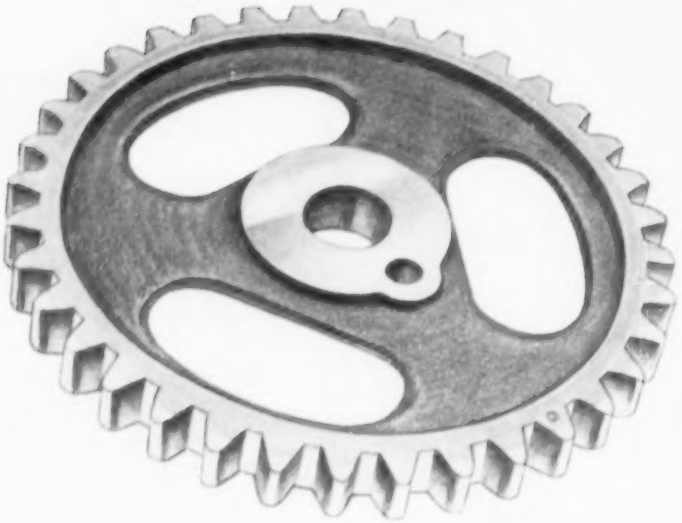
GROOVE GAGES

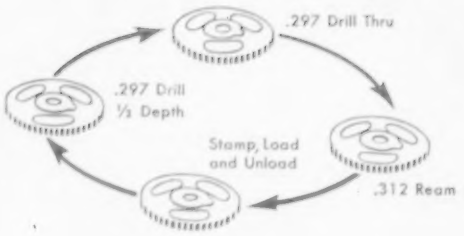
I.D.
O.D.
Depth
Concentric
Width

Model 99P-10

Model 99P-11

Model 99P-12



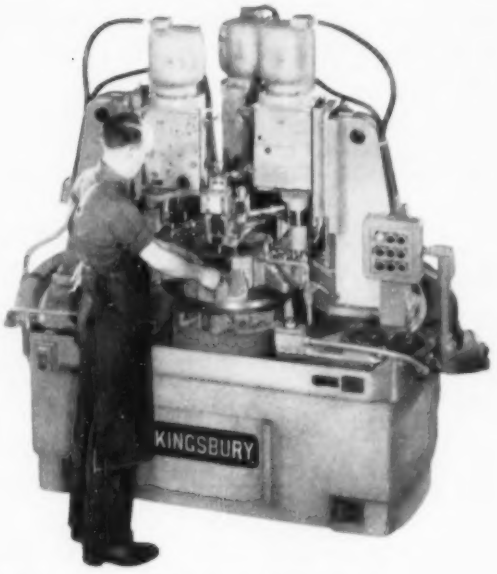


450 PER HOUR GROSS

- **DRILLED**
- **REAMED**
- **STAMPED**

— on this high production

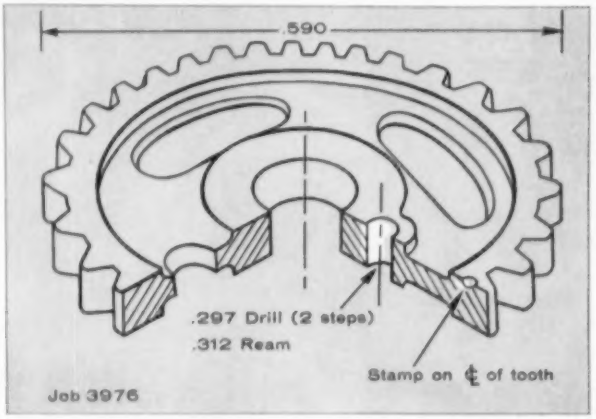
KINGSBURY



This 4-station Kingsbury has a 72" semi-circular base, 20" index table, JIC electrical controls (not shown)

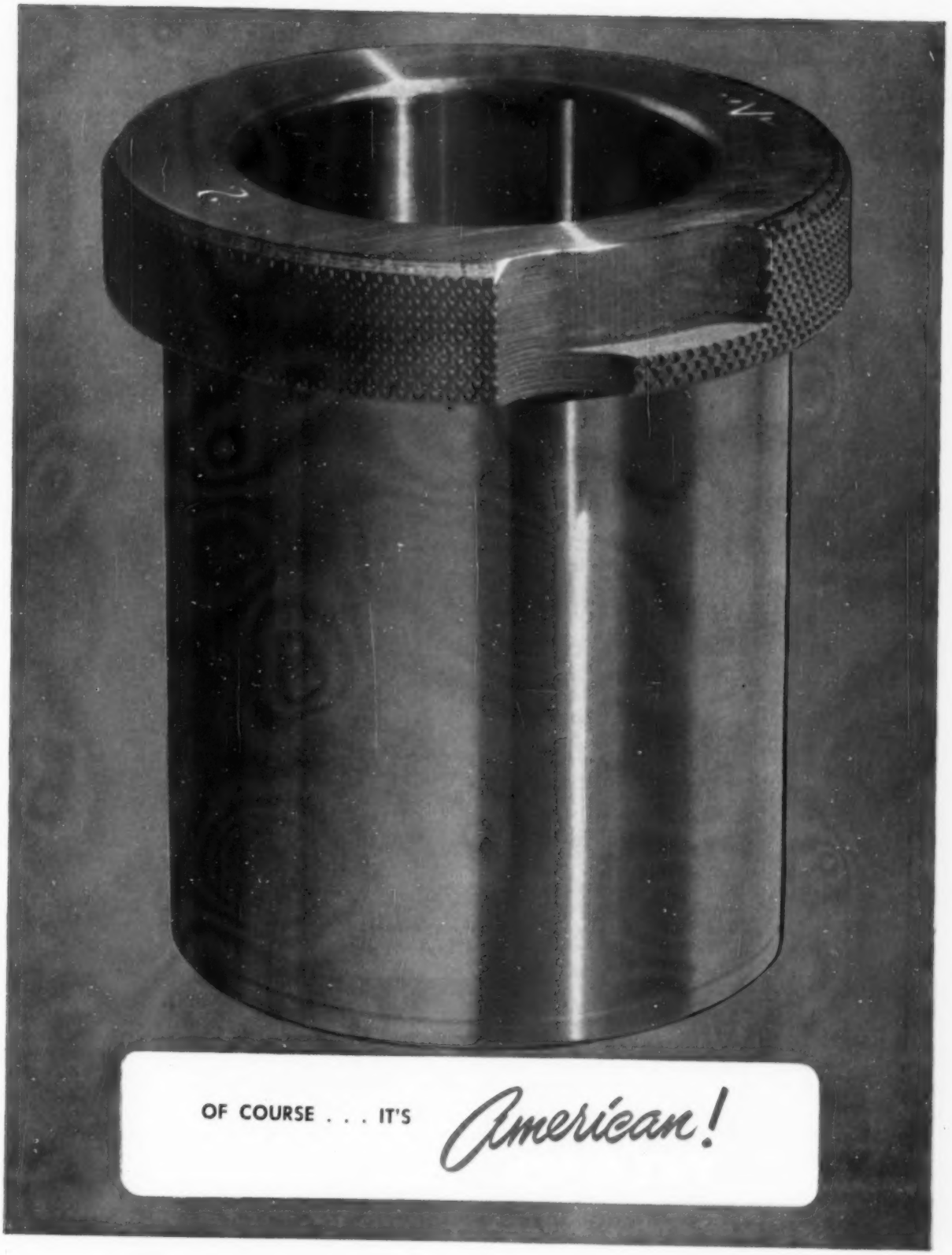
This machine has three single-spindle vertical units, two for drilling and the third for reaming. Drilling in two steps shortens the time cycle, thereby increasing the hourly production. A special mechanism at the operator's station stamps the gear. The operator has only to load the work, push a button, unload completed work. All operations are done automatically at each station.

Kingsbury indexing automatics are built for jobs as simple as this one, to complex ones involving a dozen or more drilling, tapping and other operations. In every case, the customer gets a fully tooled machine, ready to produce at the rates he wants. If you have operations like these, we'd like to show you how economically they can be done on a Kingsbury. Kingsbury Machine Tool Corporation, Keene, N. H.



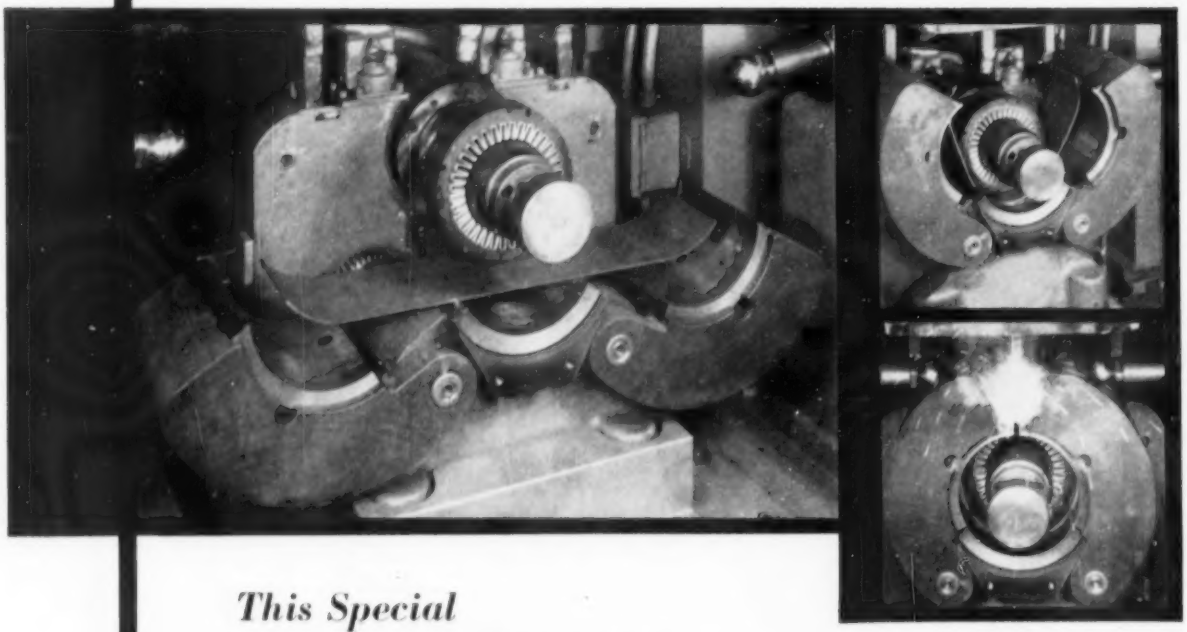
KINGSBURY

INDEXING AUTOMATICS
for high production drilling and tapping



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-17

Another Special by **STANDARD–MODERN**



This Special
AUTOMATIC WELDER

precision forms and welds stator core assemblies in 36 seconds*

The time-consuming process of wrapping stator cores for fractional horsepower electric motors is reduced to a swift, precision job by this Standard-Modern Automatic Welder.

The operator simply places a strip of flat steel stock with preformed ends under the wound stator core, which is held on a central spigot, and presses the cycle start buttons.

Steel jaws wrap and clamp the strip around the core, leaving a gap of about 1/32 inch. With an inert gas shield and wire filler, the gap is then welded automatically. Shrinkage of the weld permanently binds core and shell together. The forming jaws then automatically release the completed assembly for removal.

A formerly slow and troublesome hand operation is accomplished—accurately and uniformly—in 36 seconds, a fraction of the time formerly taken.

*Average floor to floor time.

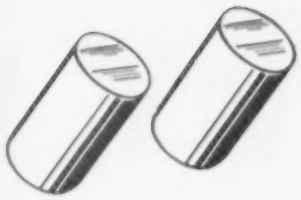
STANDARD-MODERN Special Machines are speeding production, saving time and money for industry across Canada.

STANDARD–MODERN
TOOL COMPANY LIMITED
MANUFACTURING DIVISION

69 Montcalm Avenue, Toronto, Canada • 3030 Walker Road, Windsor, Canada

• SP-3

cold cuts



BY MOTCH & MERRYWEATHER

For most accurate end results in cold extrusion, cut slugs with a Motch & Merryweather 0-4 Circular Sawing Machine.

. . . make better COLD EXTRUDED PARTS

The Motch & Merryweather No. 0-4 Precision Circular Sawing Machine is automatic from the storage table to the finished cut slug. It cuts slugs accurate to ±.002" with uniformly square ends and minimum burr. Give your cold extrusion press the opportunity of producing more work than ever before, with more accuracy than ever before, at a lower cost per piece than ever before.

THE MOTCH & MERRYWEATHER MACHINERY CO.

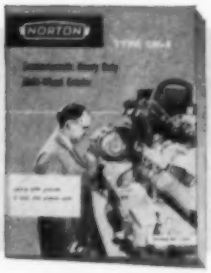
MACHINERY MANUFACTURING DIVISION
CLEVELAND 13, OHIO

Builders of Automatic Precision Cut-Off, Milling and Special Machinery

CYLINDRICAL GRINDERS

10" Type CTU and 14" Type LCTU. Semiautomatic or plain. For plunge or traverse operations, from roughing cuts to finest finishing. Can take a wide range of multi-wheel mounts. In production line and job shop work these machines have doubled production, replaced several machines, eliminated extra operations. *Catalog No. 1787*

10" Type CV-4 and 14" Type LCV-4 Angular Wheel Slide. Semiautomatic machines that grind thrust surfaces and adjacent diameters in one fast, automatic plunge operation. They leave a concentric grain pattern in the thrust surface finish, assuring a better seal surface and appearance. *Catalog No. 1658*



Type CM-1 Heavy Duty Multi-Wheel. Semiautomatic. Makes four or more cuts simultaneously, in a single plunge-grind cycle. Brings new speed, accuracy and economy to the grinding of multi-diameter parts. Many automatic features, including one-lever control. *Catalog No. 1550*

ROLL GRINDERS

Type C-2. A heavy duty machine, featuring faster cutting, quicker set-ups, easier operation. Available as a plain, semiautomatic or roll grinder. One-lever control of grinding cycle on the semiautomatic. As a roll grinder it includes the famous Norton tilting wheel head. *Catalog No. 1827*

CAM GRINDERS

NO. 3 CAM-O-MATIC® Cam Grinder. An automatic, hydraulic machine that is setting new standards for production, precision and finish. Grinds all cams and the camshaft eccentric successively and automatically, in one handling. Entire operation geared to split-second efficiency. *Catalog No. 191*

Check these guide books to

bigger grinding profits

Get the facts on how Norton grinding machines can benefit your production

In building the world's largest line of grinders and lappers — including automatic machines and machines for specialized operations — Norton offers you the greatest opportunities to modernize.

A representative selection of Norton machines is listed here, together with their catalogs. It will pay you to send for any catalog that concerns your grinding or lapping operations. Learn how replacing your obsolete equipment with new Norton machines will enable you to meet competition with the best production tools in the field. Learn also, how the Norton Lease and Financing Plans enable you to modernize, yet conserve your capital.

Ask your Norton representative for the literature you want, or write direct. And remember: only Norton brings you such long experience in both grinding machines and grinding wheels — to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

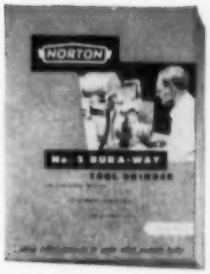
WANT MORE POWER, MORE SPEEDS?

CRANKPIN GRINDERS

Automatic Transfer Type. For completely automatic crankpin grinding — a news-making Norton *"first."* Locates, grinds, gages, transfers — all automatically — cutting costs on each crankshaft ground. Typical of Norton's rapid progress in automatic operation. *Catalog No. 1837*

CUTTER AND TOOL GRINDERS

No. 20 Cutter And Tool Grinder. Fastest, most versatile machine in its class. Wheel head tilts 15° above or below horizontal and swivels through 360°, simplifying many difficult grinding jobs. Easy to set up, operate and maintain. *Catalog No. 189*



No. 2 BURA-WAY Tool Grinder.* Unequalled for grinding convex single point and form tools. Generates, produces and maintains relief angles constant in the direction of the feed. Duplicates the master tool form exactly. Extends the life of carbide-tipped and other tools. *Catalog No. 220*

UNIVERSAL GRINDERS

Type U-4, 12" x 36" and 12" x 48". Quick, easy set-ups plus fast grinding action save time and costs on a wide variety of external, internal, face and angular wheel-slide jobs. Simply turning a dial gives an infinite number of works speeds over its 40 to 400 rpm range. *Catalog No. 231*

LAPPERS

HYPROLAP Lapping Machine No. 48F.* An extremely fast, high production machine for single or parallel face flat lapping. Bonded abrasive laps produce work pieces free of grit. Three arrangements: plain, timed cycle; automatic continuous feed; semiautomatic continuous feed. *Catalog 1954*

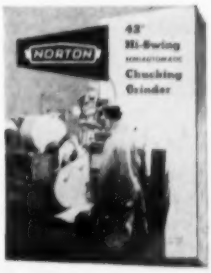
Vertical Lapping Machine No. 16FC. Outstanding productive capacity for flat work up to 3" x 5" and cylindrical work up to 3" diameter. Can produce optically flat surfaces and diameter tolerances in millionths, with fine repetitive accuracy. *Catalog No. 212.*

SURFACE GRINDERS

8" x 24" Hydraulic. Grinds plane surfaces speedily and economically, in large stock removal or close tolerance operations. Designed with both hand and hydraulic table cross feed. Convenient controls and easy accessibility reduce operating and maintenance time. *Catalog No. 190*

SPECIAL GRINDERS

42" Hi-Swing Semi-Automatic Chucking Grinder. For rapid, accurate grinding of large diameter, short parts, such as jet engine compressor wheels and similar components. Takes work held by chucks, face plates or special fixtures and permits grinding several surfaces without disturbing the set-up. *Catalog No. 1780.*



*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

To Economize, Modernize with NEW

NORTON

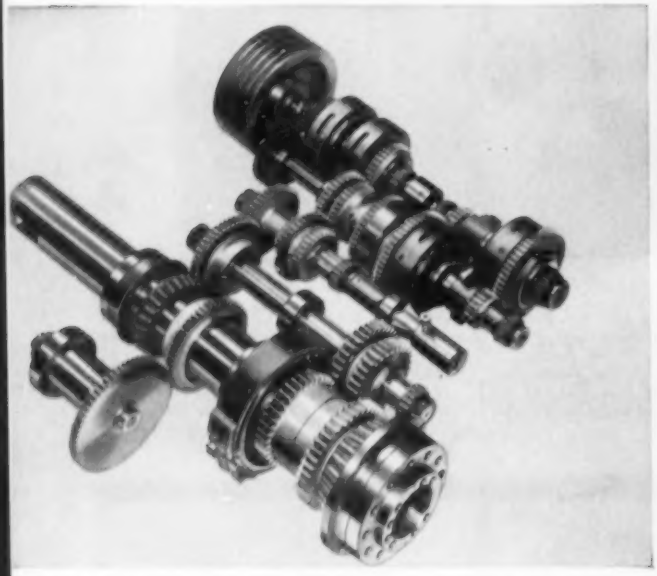
GRINDERS and LAPPERS

Making better products . . . to make your products better

District Offices: Worcester • Hartford • New York Area, Tatorboro, New Jersey • Cleveland • Chicago • Detroit

In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

WANT MORE POWER, MORE SPEEDS?



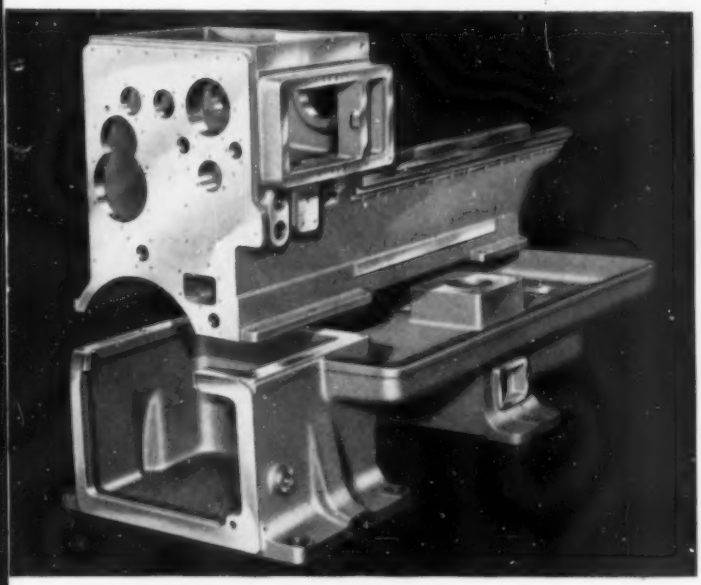
NEW HEADSTOCK GEAR TRAIN—sixteen different spindle speeds available, powered by up to 30 h.p. single-speed driving motor delivering full power at all speeds. Spindle is mounted on selected pre-loaded, precision-tapered roller bearings. Heavier, more rugged design provides smoother, quieter power.

HYDRAULIC SPEED SELECTOR—smooth, effortless speed changes. No waiting, no computing, no stopping of spindle, no releasing of main drive clutch. Operates direct or pre-set. Hi-Lo Lever permits instantaneous speed changes in 8:1 ratio without moving Speed Selector handwheel. Multiple Disc Clutches have automatic take-up for wear.

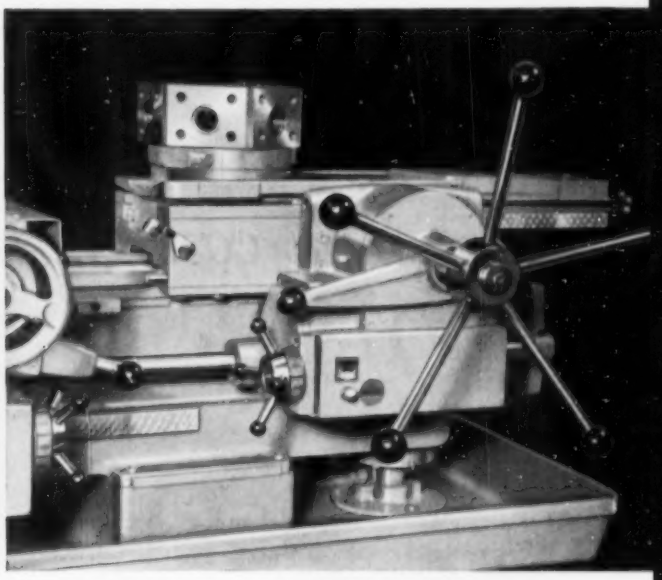
YOU GET THEM ALL...PLUS

NEW GISHOLT MASTERLINE

WANT HEAVY CUTS WITHOUT VIBRATION?



NEW HEADSTOCK AND BED CASTING—scientific design dampens out vibrations, assures smooth operation and simplifies holding closer tolerances. Made from semi-steel, poured in Gisholt's own foundry. Greater swing over ways permits bigger chucks and broader range of workpiece sizes. Provides a solid foundation for all types of work.



NEW TURRET RAM AND SADDLE—designed wider, heavier, more rigid to handle increased capacity and higher speeds. Dial-type feed selector makes feed changes faster, easier. Turret ram rigidly supported on 64-66 Rockwell C alloy steel way strips. Power transmitted through serrated tooth clutches, with shear pin protection against overloading.

GREATER VERSATILITY...WITH THE

RAM TYPE TURRET LATHE

YOU'LL SPEED UP your production jobs—both large and small—with this more powerful, more versatile Gisholt MASTERLINE Ram Type Turret Lathe.

Here is a machine designed from end-to-end for easier setups, faster change-over and higher productive output than ever before. Check the advanced features illustrated above. Note the reserve power to handle your heaviest cuts—and to meet your tooling requirements of tomorrow. Note the extra spindle speeds—all at your operator's finger tips, without computing—for faster, better turning of any type material. And look over the new massive design, the over-all ruggedness that permits greater accuracy, closer tolerances, deeper cuts at punishing feeds without vibration.

Find out now how this powerful, flexible Gisholt MASTERLINE Ram Type Turret Lathe can reduce floor-to-floor time on your specific jobs. Call your Gisholt Representative today—let him show you how this advanced machine can fit most profitably into your production picture. Or write direct to Gisholt for the new literature described below.

READY NOW—all-new, 18-page illustrated Bulletin No. 1174-B, covering features, accessories, tools and floor plans on new Gisholt MASTERLINE Ram Type Turret Lathes. Ask for it!

GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

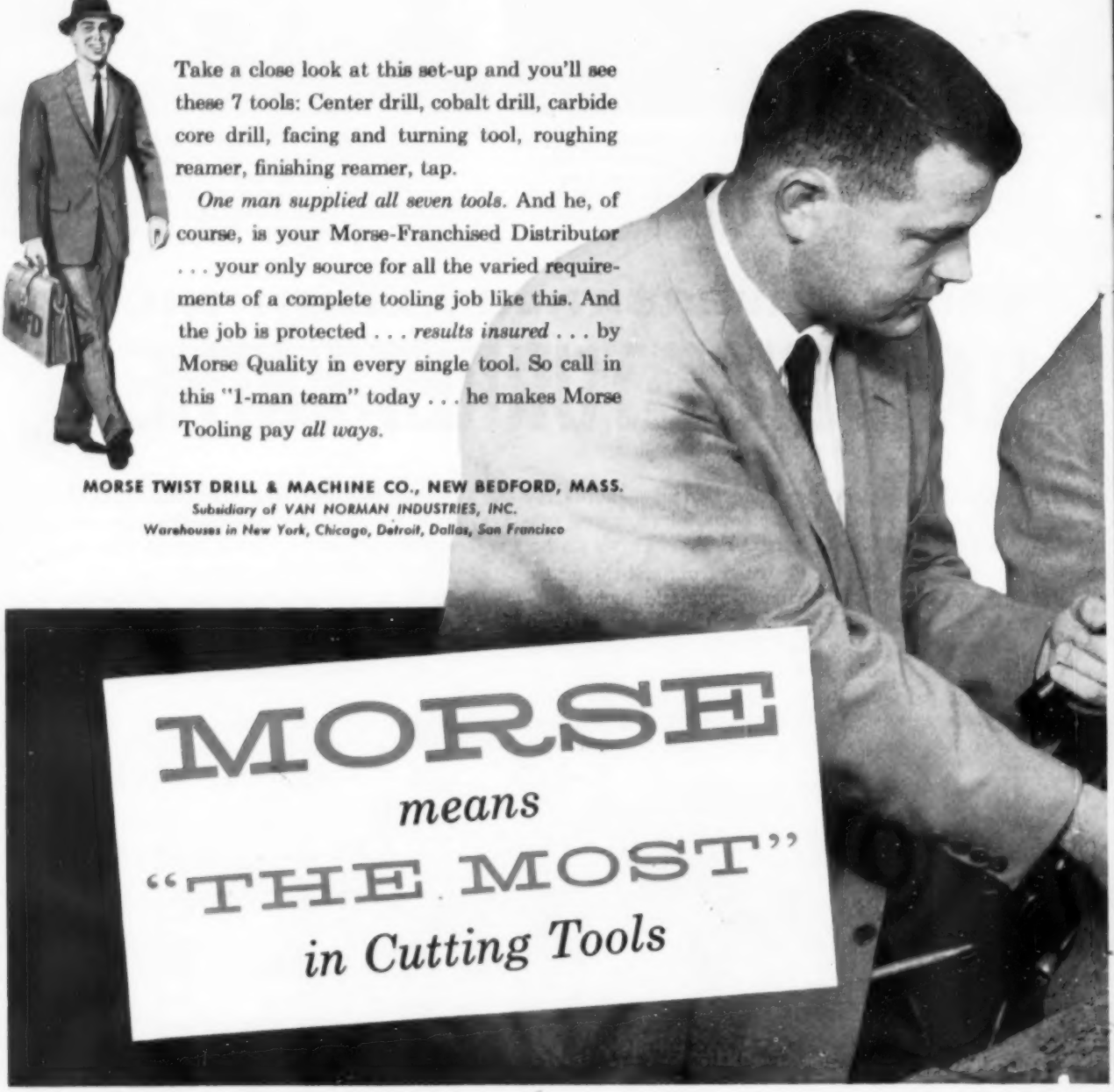
No matter how many cutting tools You can get the "whole package"

MORSE-FRANCHISED

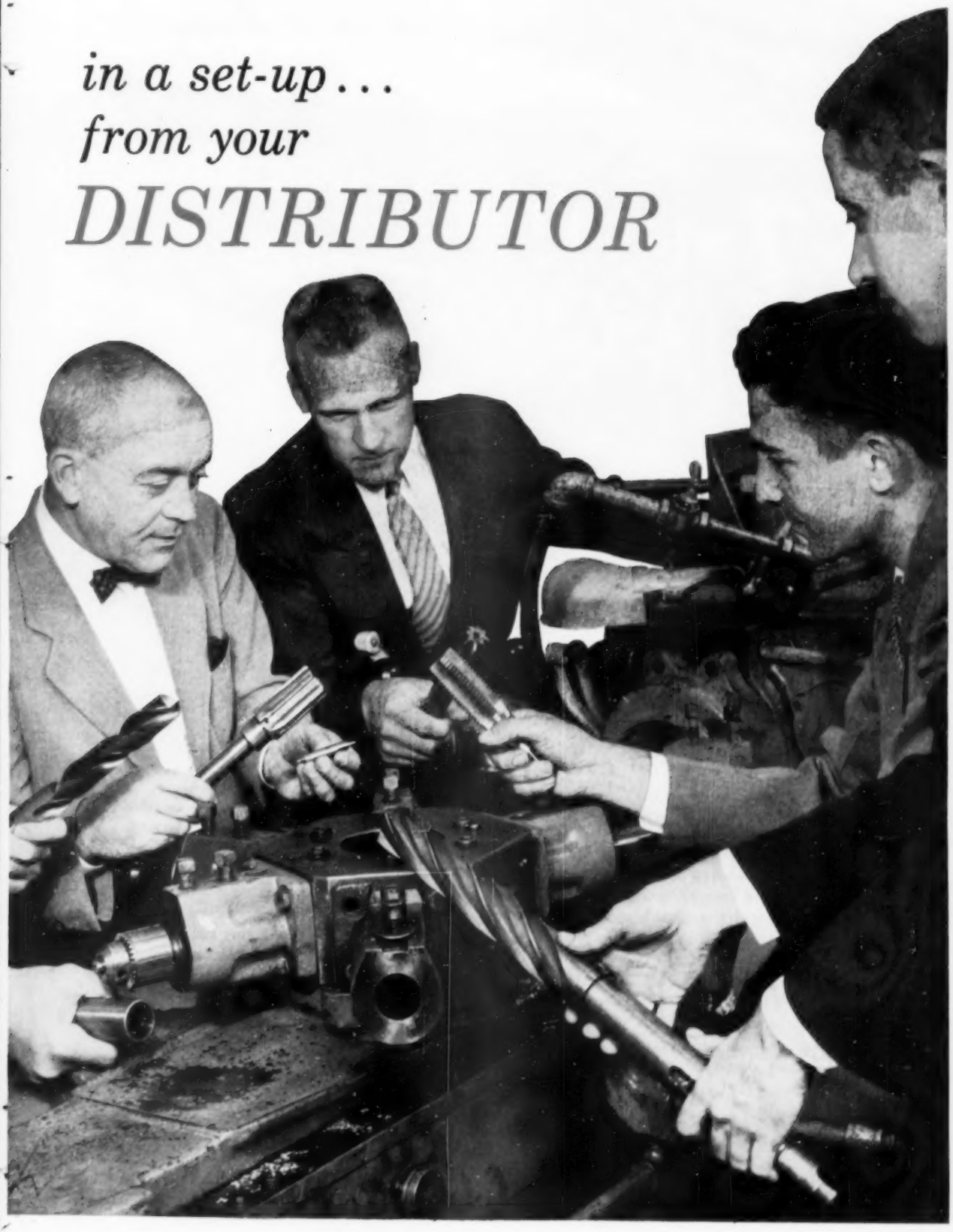
Take a close look at this set-up and you'll see these 7 tools: Center drill, cobalt drill, carbide core drill, facing and turning tool, roughing reamer, finishing reamer, tap.

One man supplied all seven tools. And he, of course, is your Morse-Franchised Distributor . . . your only source for all the varied requirements of a complete tooling job like this. And the job is protected . . . *results insured* . . . by Morse Quality in every single tool. So call in this "1-man team" today . . . he makes Morse Tooling pay *all ways.*

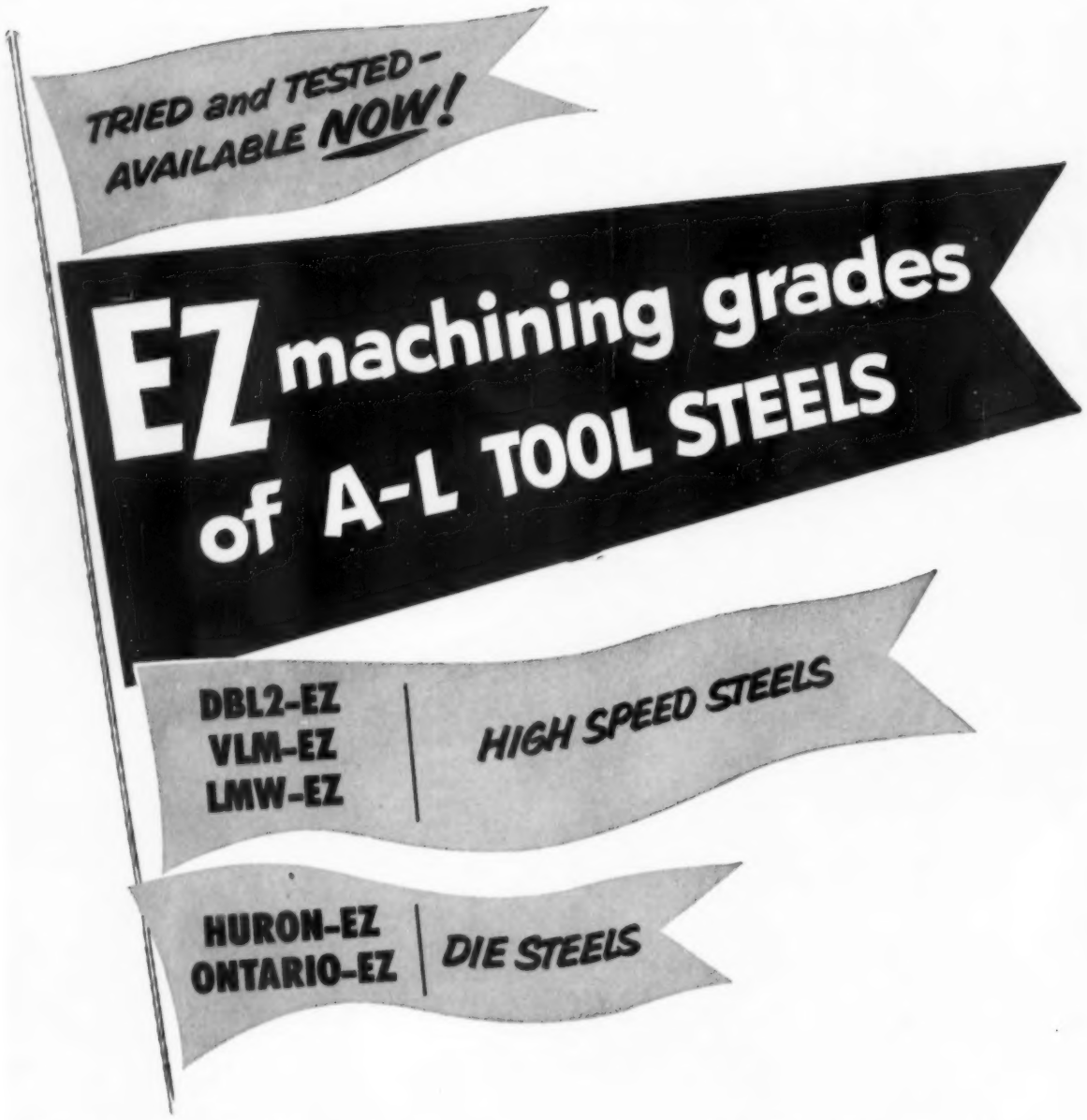
MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASS.
Subsidiary of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco



in a set-up . . .
from your
DISTRIBUTOR



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-25



"EZ" is a well-known symbol to users of Allegheny Ludlum products. We've been producing easy-machining stainless steel grades under that symbol for many years . . . they're a standard in the industry for improved machining characteristics.

This long experience, applied to the "EZ"-machining grades of the three High Speed and two Die Steels listed above, is your assurance of dependably uniform free-cutting qualities and improved finish. Users of Ontario EZ-Machining Die Steel, for example, will be delighted with the improved tool life and better finish secured, and the saving in machining time. Also highly popular: DBL 2-EZ High Speed Steel.

All five grades have been thoroughly proved and are readily available in the usual wide range of shapes and sizes. ● Write for literature on the grade(s) in which you are interested.

Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.

ADDRESS DEPT. TE-88

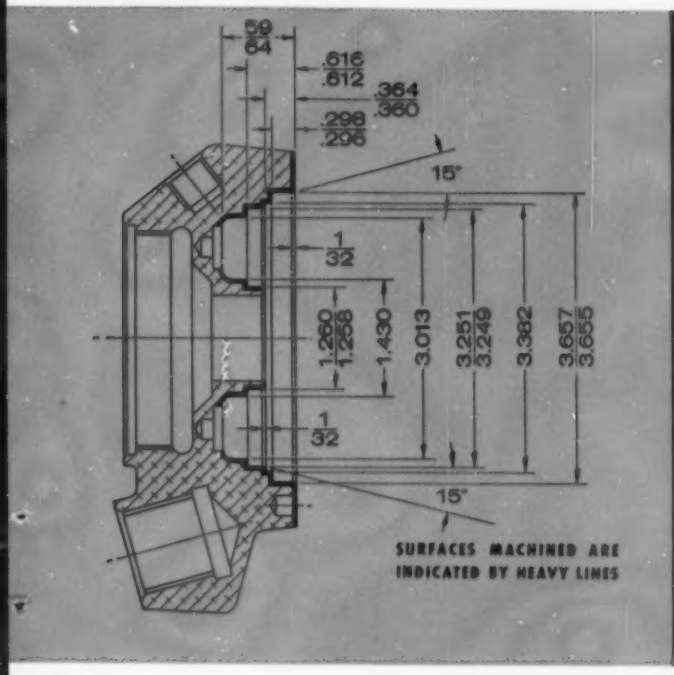
For complete **MODERN** Tooling, call

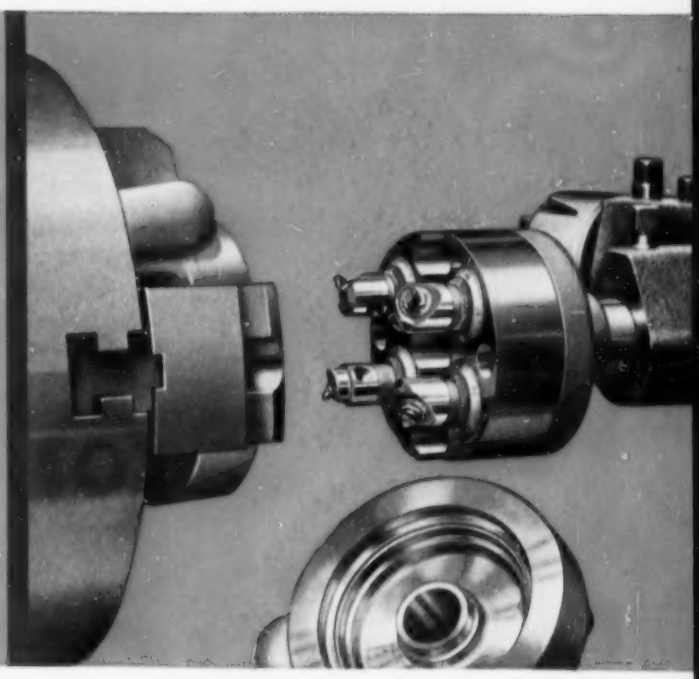
Allegheny Ludlum

WSW 6287

AL® FINE TOOL STEELS SINCE 1854

13 surfaces finish machined in 2 passes...





HERE'S HOW MICROBORE CLUSTER TOOLING DOES IT ON A TURRET LATHE!

This Special Microbore Production Tooling was designed for a well known hydraulic pump manufacturer to machine pump covers on a turret lathe. Operations include precision boring and turning thirteen diameters and faces in only two passes. Think of the costly manhours saved and down time eliminated in comparison with conventional, piecemeal methods of handling this same job.

ACCURACY IS AN ECONOMY—With the Microbore System of cluster tooling, independent precision adjustment of each Microbore tool point permits accurate settings in a matter of seconds. On piece after piece, machined surfaces are held to extremely fine limits.

Microbore is a versatile tool that can be applied singly or in clusters for all types of boring, turning and facing operations. Microbore also manufactures Standard Boring Bars, Boring Bar Sets and Microbore Flash-Change Tooling—the ultimate for quick change tooling.

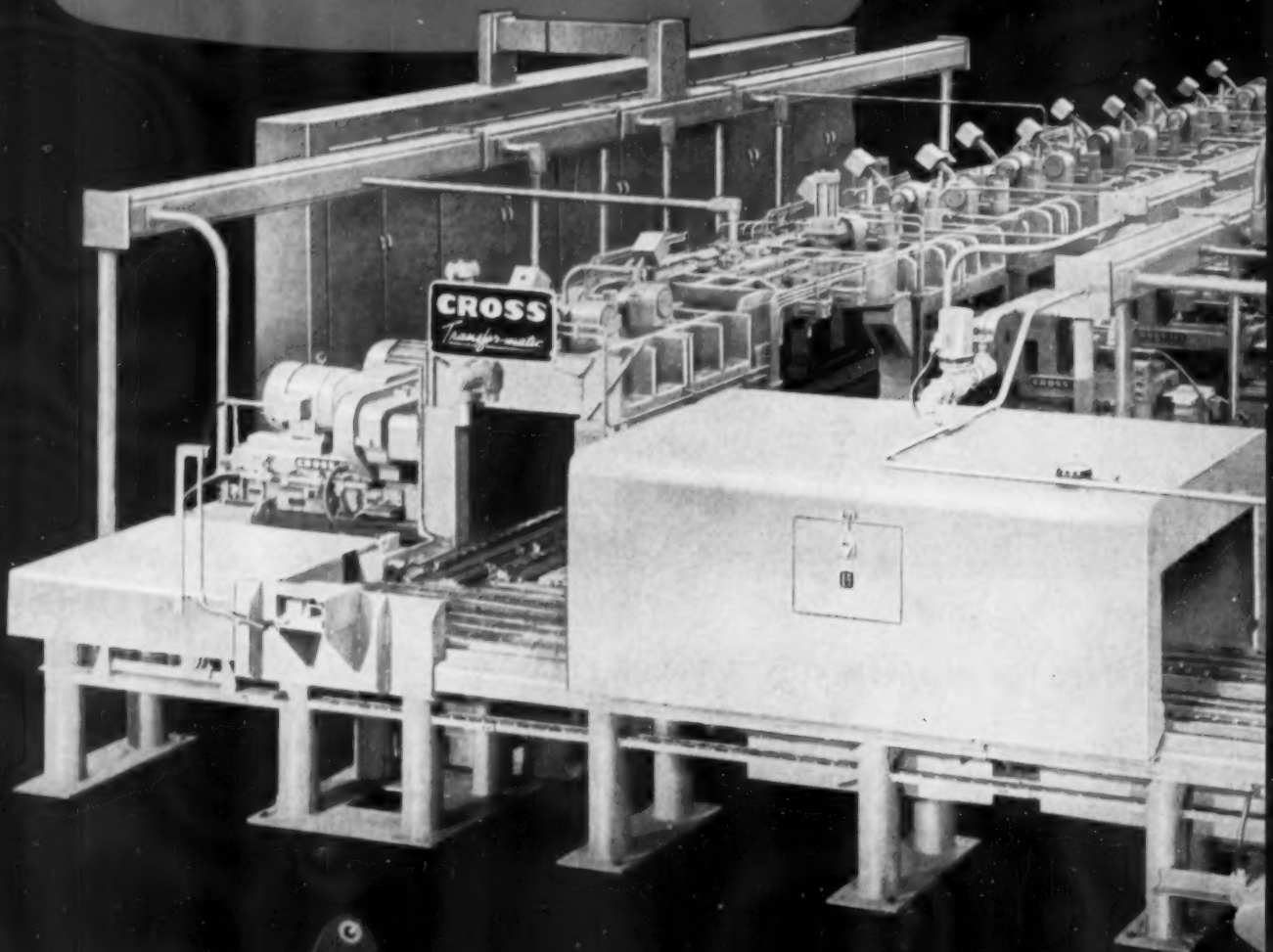
• Join the leaders who are already multiplying their profits with modern Microbore tooling and methods. Write for Catalog No. 56.

DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

Mills, Drills, Reams, Threads Integral Front Wheel Spindle and Steering Arm



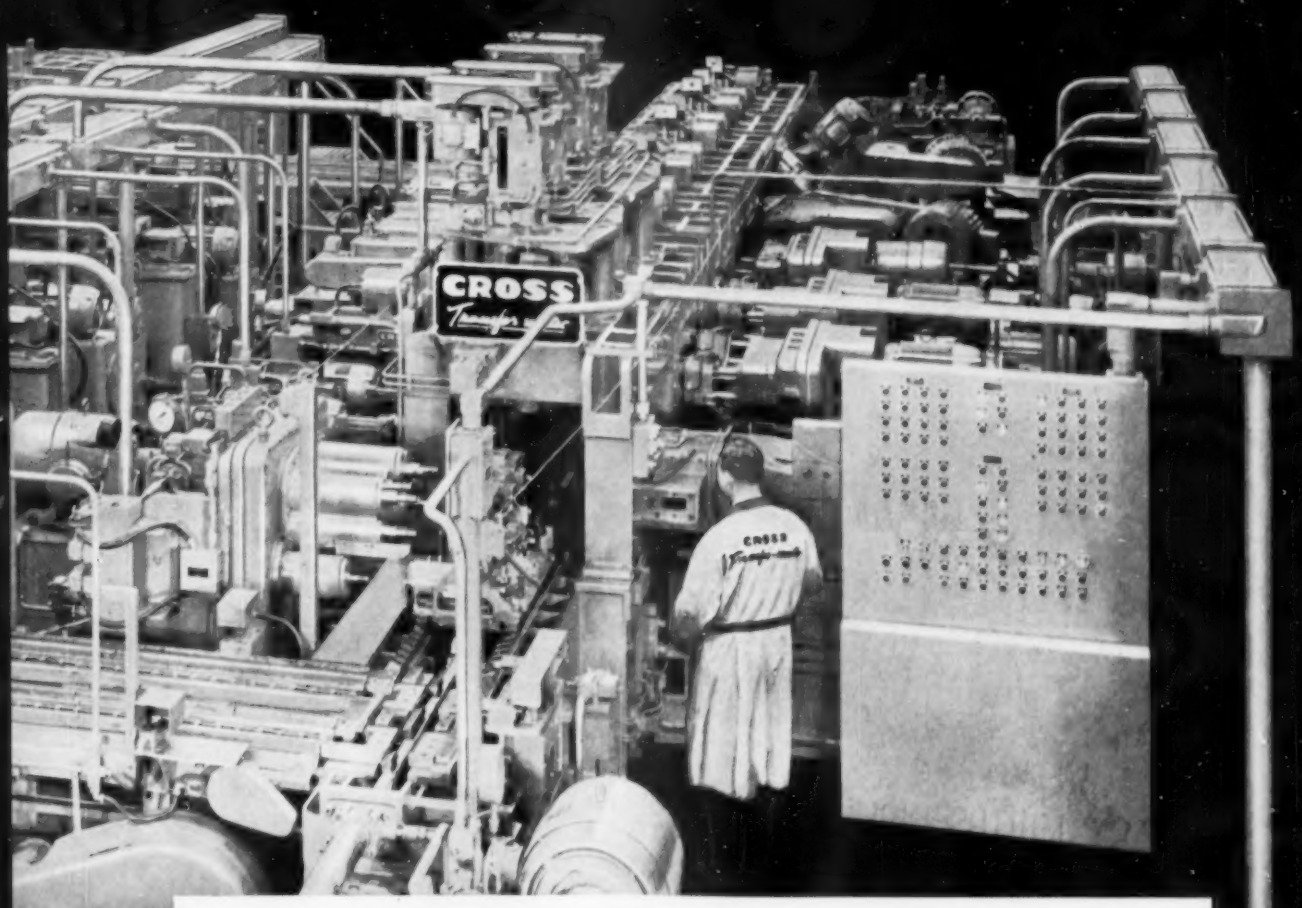
Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Another Transfer-matic by Cross



★ Straddle mills upper and lower support arm bosses; straddle mills steering arm boss; mills steering arm stop pad; mills spindle keyway; drills and taper reams upper and lower support arm holes and steering arm hole; drills, reams, chamfers and spotfaces two brake mounting plate holes; drills, counterbores, spotfaces, chamfers and reams brake anchor hole; drills spindle cotter pin hole; and threads wheel spindle.

★ 144 right and 144 left hand parts per hour at 100% efficiency.

★ Pallet type work holding fixtures locate parts from spindle bearing diameters.

★ Power wrench clamps work holding fixtures automatically.

★ Gravity operated cam clamps for the work holding fixtures.

★ Automatic transfer mechanism indexes right and left hand parts through all 17 stations in pairs.

★ Automatic indexing units turn fixtures 82° at Stations 11 and 17.

★ Cross modular unit construction provides flexibility for design changes.

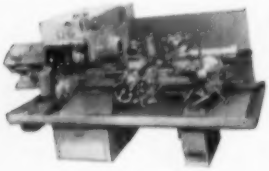
★ Other features: construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and reaming; individual lead screw feed for threading; automatic fixture cleaning unit; complete interchangeability of all standard and special parts for easy maintenance.

When the going gets tough...

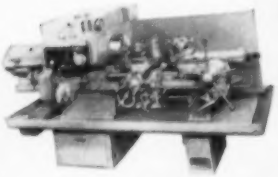
RAM TYPE TURRET LATHES

NO. 2 ALL-GEARED HEAD
1" Bar Capacity
14" Swing

NO. 3 UNIVERSAL
1½" Bar Capacity
15⅜" Swing

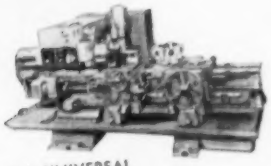


NO. 4 UNIVERSAL
2" Bar Capacity
18⅛" Swing

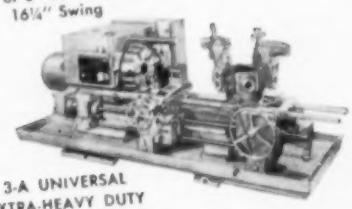


NO. 5 UNIVERSAL
2½" or 4½" Bar Capacity
20" Swing

SADDLE TYPE TURRET

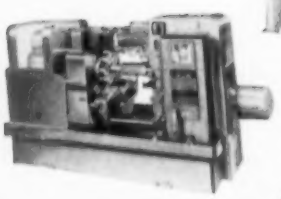


1-A UNIVERSAL
EXTRA-HEAVY DUTY
2½" or 3" Bar Capacity
16¼" Swing

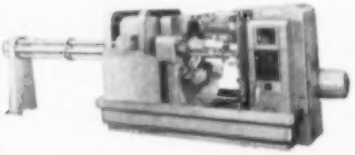


3-A UNIVERSAL
EXTRA-HEAVY DUTY
4½" or 6" Bar Capacity
23½" Swing

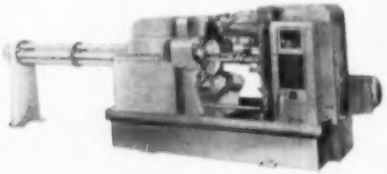
MULTI-SPINDLE AUTOMATICS



5-SPINDLE
CHUCKING MACHINE
6" Swing



5-SPINDLE BAR MACHINE
1⅜" Standard Bar Capacity
2¼" Oversize Capacity



6-SPINDLE BAR MACHINE
1¼" Bar Capacity

SINGLE SPINDLE

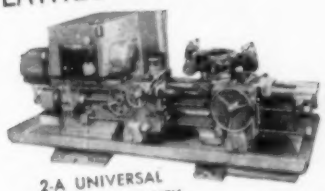
1 AC CHUCKING MACHINE
8" or 10" Chuck—6" Working Stroke

2 AC CHUCKING MACHINE
10" or 12" Chuck—9" Working Stroke

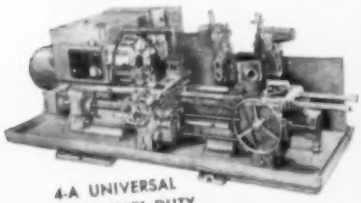
YOU CAN PRODUCE IT

put it on a Warner & Swasey

LATHES

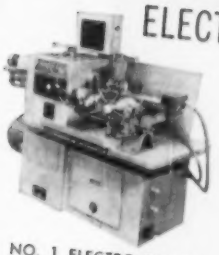


2-A UNIVERSAL
EXTRA-HEAVY DUTY
3½" or 4½" Bar Capacity
20" Swing

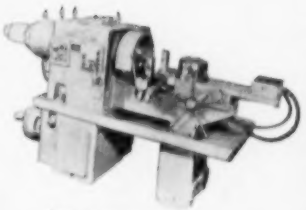


4-A UNIVERSAL
EXTRA-HEAVY DUTY
9" or 12" Bar Capacity
28¼" Swing

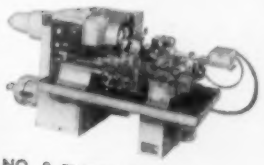
ELECTRO-CYCLES®



NO. 1 ELECTRO-CYCLE
⅝" Bar Capacity
11" Swing



16" ELECTRO-CYCLE
1⅛" Bar Capacity
16⅞" Swing



NO. 3 ELECTRO-CYCLE
1½" Bar Capacity
15⅜" Swing

® Reg. U. S. Pat. Off.

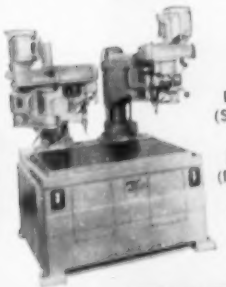
AUTOMATICS

3 AC CHUCKING MACHINE
15" Chuck—
11" Working Stroke

PRECISION TAPPING AND THREADING MACHINES

NO. 10
TAPPING
MACHINE
0-80 to
10-24 Capacity

NO. 11
TAPPING
MACHINE
8-36 to
⅞" Capacity



NO. 11
RS RADIAL
(Single Head)
NO. 11
RD RADIAL
(Double Head)
8-36 to
⅞" Capacity

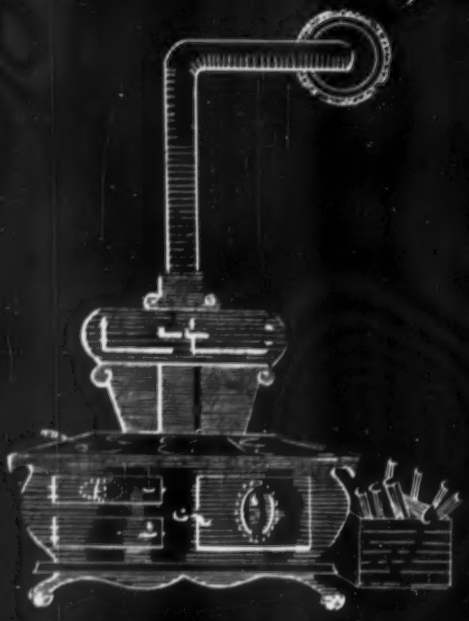
NO. 12
TAPPING
MACHINE
⅜" to
2½" Capacity

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

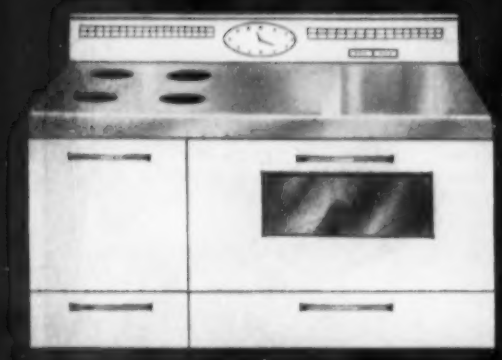
BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-31

Great in its day...



BUT WOULDN'T YOU
RATHER HAVE THE LATEST
TECHNICAL ADVANCE?



NOW
the latest technical
advance in tools . . .

"Job Tempered"

HAND and POWER

Hack Saws

Certified by American Standards Testing Bureau to meet their standards for superior cutting — Uniform Teeth . . . Uniform Set . . . Uniform Temper*

FROM Heller

Now you can cut all kinds of metal faster *and* cheaper . . . with hand or power hack saws . . . thanks to Heller's great new advance in tool technology — JOB TEMPERING.

Controlled-analysis steel is specially selected to strict Heller specifications, then Heller uses its own *unique* heat treating method to bring every blade to the precise hardness and temper to accomplish the class of work for which it is intended.

The result: JOB TEMPERED hand and power hack saw blades perform better and last longer on the toughest cutting jobs.

Based on this new development, every Heller blade is certified by American Standards Testing Bureau* to meet the three vital requirements for superior metal cutting — *Uniform Teeth, Uniform Set and Uniform Temper.*

You can choose the right JOB TEMPERED Blade from Heller's complete line. And if your sawing problem involves economy as well as the proper use of power hack saw blades, a HELOMETER will help prolong blade life, improve cutting and speed set-ups by showing you when blade tension is precisely correct.

Big Benefits in the Heller Line of "Job Tempered" Hack Saw Blades

GIVE US YOUR TOUGHEST HACK SAWING PROBLEMS

We'll show you how the *right* Heller JOB TEMPERED Blade can solve it efficiently and economically — delivering faster, smoother, trouble-free cutting over longer periods than ever before.

HERE ARE THE FACTS!

New Heller Hack Saw Catalog gives full information on sizes and types offered . . . shows why Heller JOB TEMPERED Blades, backed by the American Standards Testing Bureau*, are best in job performance.

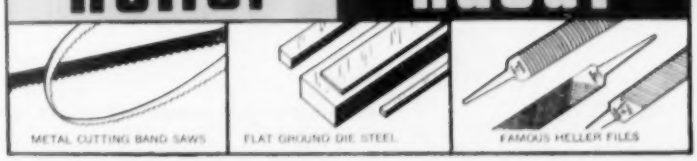
WRITE FOR YOUR COPY TODAY.

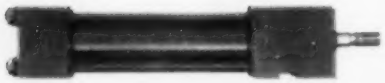
SOLD *EXCLUSIVELY* THROUGH

Heller DISTRIBUTORS
"YOUR OUTSIDE TOOL ROOM"
Heller "Job Tempered" Tools

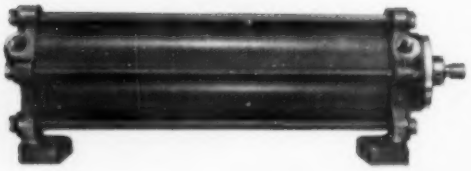
HELLER TOOL CO.
America's oldest file manufacturer
Newcomerstown, Ohio
A subsidiary of Simonds Saw and Steel Co.

Heller nucut





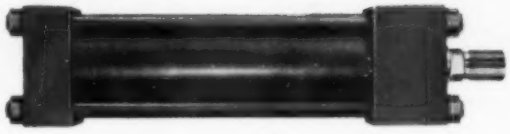
Five cylinder series... each the best of its kind!



Here you see one more reason why experienced cylinder users prefer Hannifin cylinders...there is a Hannifin cylinder series for every type of service.

What pictures cannot show you is the extra effort that goes into every Hannifin cylinder, all the way from the drawing board to the shipping dock. This brings you design features other cylinders simply do not have...superior workmanship where it's most needed for long, trouble-free service...and better delivery promises, better kept. All at prices no higher than you may have been paying for less satisfactory cylinders.

There's a Hannifin man near you—or, if the need is urgent, call us long distance. He or we will welcome the opportunity to help you as you select the Hannifin cylinder series that best meets your needs.



AIR AND HYDRAULIC

HANNIFIN

POWER CYLINDERS

COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File . . . complete easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Write Hannifin Corporation, 519 S. Wolf Road, Des Plaines, Illinois.

Photo courtesy The Monarch Machine Tool Company

THE LATHE — *Monarch Series EE Model 1000 Precision Lathe*

THE OPERATION — *The turning of a stub shaft*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

HORTON
Since 1851
CHUCK

Call Your Horton Distributor Now!

Joe Doesit, Machine Operator, says:

"I LIKE MY GEOMETRIC DIE HEADS because...

...they never let me down. You see, I'm on piece work and if one of these Die Heads acted up, it would mean the same as a cut in pay. But you can always count on a GEOMETRIC Head to stand the gaff. They're plenty rugged. I like the quick way you can change chasers, too."

Greenfield Tap and Die Corporation

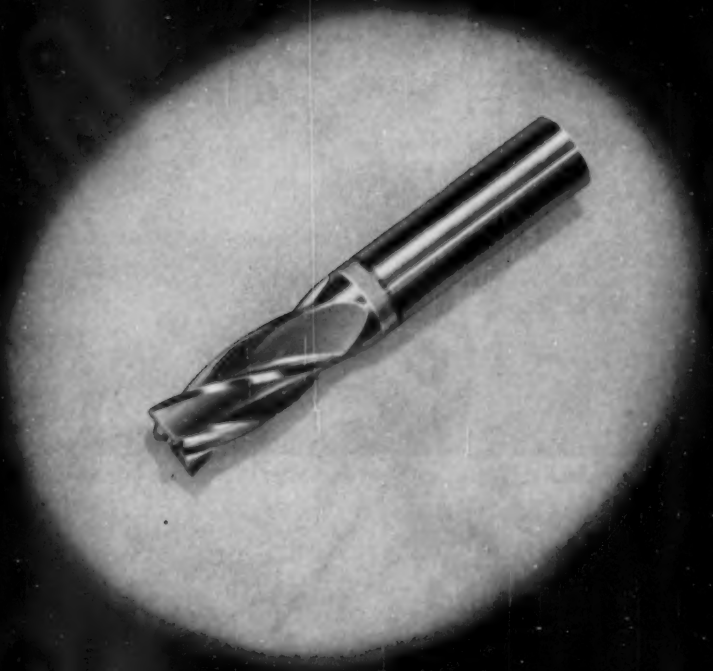
GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

GEO MET RIC

new electro-ground carbide end mills

manufactured by **ELGIN**



Elgin GOLDEN CIRCLE Carbide End Mills . . . solid carbide, of course, for the toughest jobs. But most important, Elgin Golden Circle End Mills are ground by Elgin's new Electro-Grind process which completely eliminates the strains and grinding checks caused by conventional methods. No chance for chipped or flaked cutting edges caused by high temperatures during grinding!

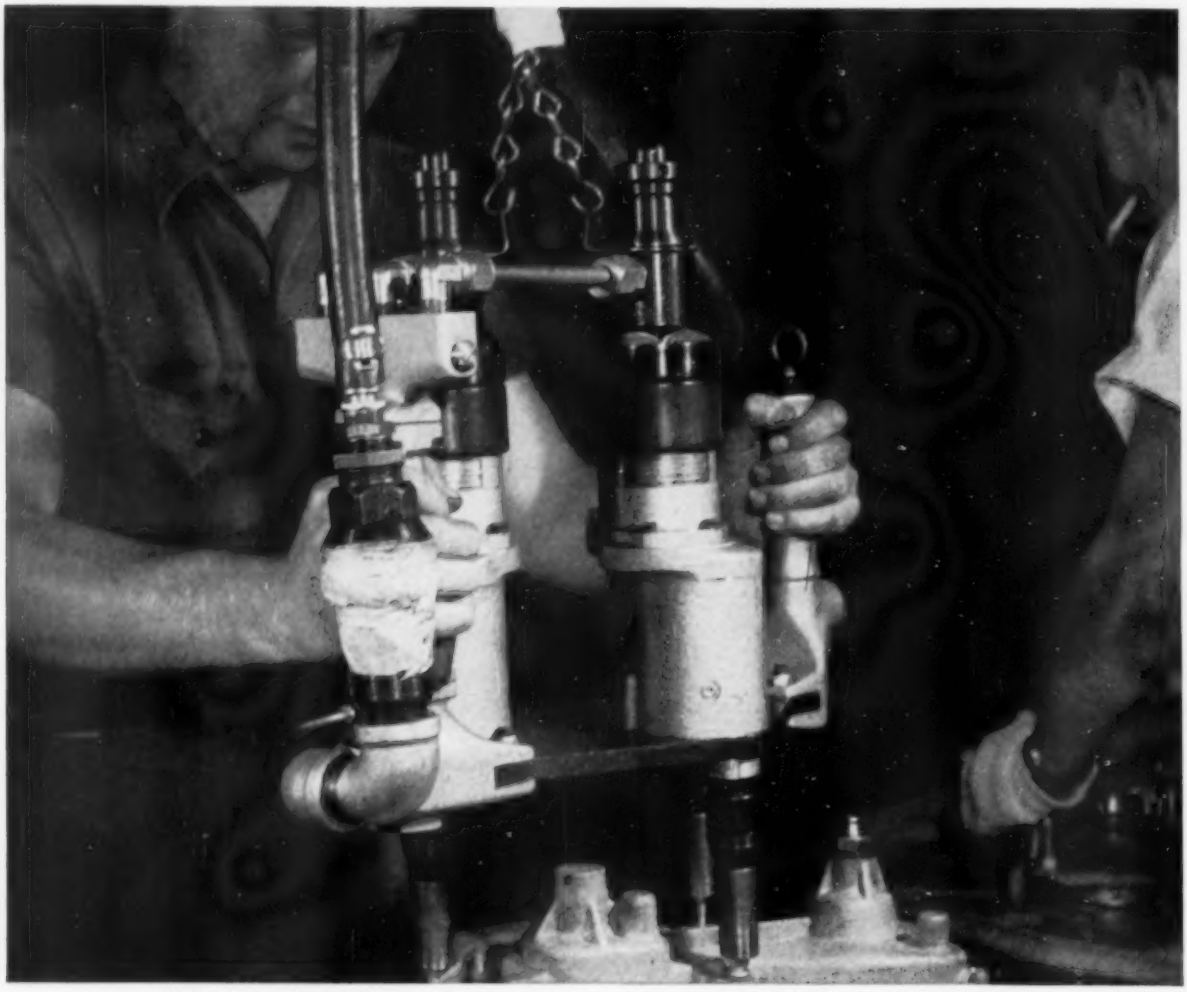
Electro-Grind combined with the use of extra fine grit wheels gives the sharpest, smoothest cutting edges yet—your assurance of the highest quality tools obtainable, increased production, less frequent regrinding, greater accuracy.

Write for new catalog showing complete line of solid carbide end mills, drills, reamers and burs—in stock for immediate delivery.

Abrasives Division

ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS



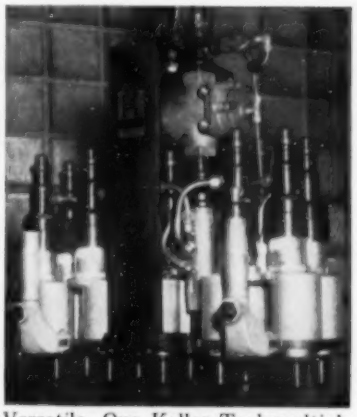
Keller 3-spindle, multiple nut setter used on moving assembly line. Spindle model is 16J43.

1 operation replaces 3

What happens when a Keller Tool multiple nut setter runs three bolts, simultaneously, to fasten gear case to base plate?

1. **ASSEMBLY TIME SHORTENED** over former method.
2. **ACCURATE NUT RUNNING.** Each spindle applies identical torque. Sets fasteners tight to manufacturing specifications.
3. **INDIVIDUAL INSPECTION** eliminated.
4. **FULL-TIME PRODUCTION** of two nut setters . . . 3250 units daily.

Keller tools are saving time in many production operations. Lower costs and increased quality are assured. A Gardner-Denver representative will gladly discuss your specifications at any time.

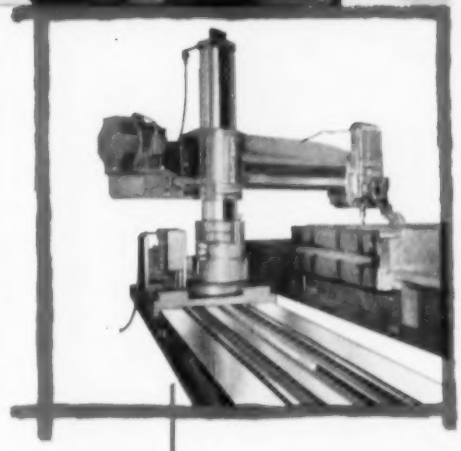


Versatile. One Keller Tool multiple nut setter . . . ten operations. Each spindle can apply individual torque to different size nuts.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

GARDNER - DENVER

KELLER TOOL division, Grand Haven, Michigan



Specialists do the job better: they're on the ball

The fellows most on the ball are those who concentrate on one thing . . . and do it well. Carlton has concentrated on radial drill research, engineering and manufacturing since 1916. This close contact with—and intimate knowledge of industry's drilling requirements—has produced a wide line of the most modern and up to date radial drills. Made in arm lengths from 3-ft. to 12-ft., column diameters from 9″ to 26″. Programming, pre-select, partial pre-select and manual speed-feed controls, plus special bases, tables and jigs available for additional productivity. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton SPECIALISTS IN RADIAL DRILLS

A "useful life" is not

for production men

This Avey machine drills various patterns of holes in jet engine parts by changing program drums or by alternating two automatically-driven shot bolts which locate the table accurately from a radial position. Program drum also programs one or more of the four drilling units for drilling, reaming, and similar operations.

The machine consists entirely of standard Avey units: four Aveydraulic automatic units with 12″ feed; cast iron columns; 120″ fan type steel base; 60″ Electrodex table. Top column and unit have an in-and-out traverse of 20″. The ways are mounted on steel adaptor blocks which can be removed for different heights.

All units and the index table are push button-controlled.

If you're looking for flexibility in a special machine, your Avey man's the man to see.

for management

Many machine tool buyers were caught between the tax authorities' "useful life" of 20-25 years and their machines' profitable life of 6-7 years. If you were caught in this dilemma, you recovered only a fraction of a machine's cost through depreciation by the time it should have been replaced; so you couldn't build up any replacement reserve.

Now you have a collection of antiques which lose nearly as much money in production as they do when they're down. Furthermore, they lack the productive capacity to keep pace with your currently expanding markets.

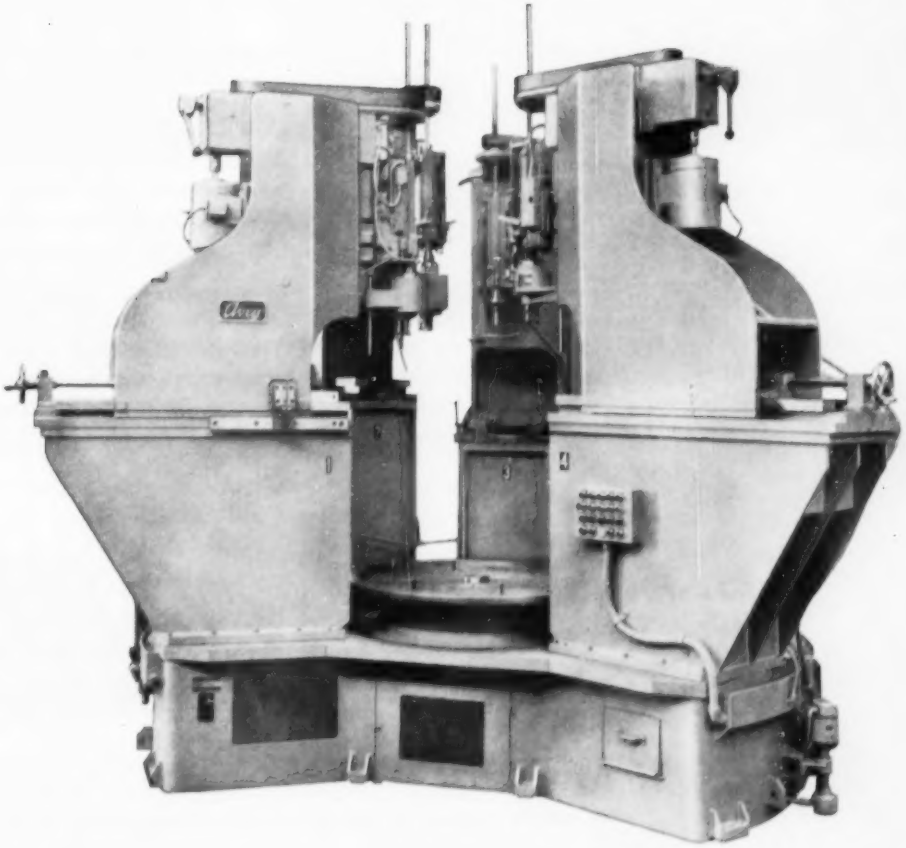
Avey has a combination to get you out of this dilemma: first, a pay-as-you-produce plan which solves your ready cash problem; but more important, production machines with such a fast rate of return on your investment that you'll be making clear profit in two years or less.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

a happy one

Avey



Maximum Automation Potential

PREDICTS BEFORE CAPITAL INVESTMENT

Metal removal costs too high?

Carborundum's new M-A-P Method gives you a chance to compare the advantages of coated abrasives

Maximum Automation Potential is a metal removal prediction method—predicts cost savings and production increases with the use of abrasive belts on your present or planned production operations. M-A-P is a *new* engineering service provided by The Carborundum Company. Now you can *compare* the advantages of using abrasive belts on either heavy metal removal or on the finishing or semi-finishing operations of any component part you manufacture.

M-A-P metal removal recommendations are made for you by Carborundum's coated abrasives engineers at the Carborundum plant. A study is made of your specific operation based on a few simple production facts which you provide and an M-A-P recommendation *is mailed to you* without cost or obligation—gives you the opportunity to *know* what savings can be expected *before* making a material or equipment change.

M-A-P predictions are based on facts accumulated through Carborundum's many years of abrasive experience and the abrasive machinery know-how of its Curtis Machine Division. These abrasive facts have been developed into M-A-P formulas—new positive standards for every factor which enters into grinding metal with abrasive belts.

To determine *your* Maximum Automation Potential with abrasive belts write for the M-A-P Brochure which explains this new service to industry in detail. Address inquiries to: Dept. 410 M-A-P, Senior Coated Abrasives Engineer—

The **CARBORUNDUM** Company

COATED ABRASIVES DIVISION

Niagara Falls, New York

Exactly the Power You Need

Range of horsepower, stroke, spindle speed and thrust in Ex-Cell-O Quill Type Power Units

Ex-Cell-O Hydraulic Power Units come in sizes suitable for a wide range of applications. Compact design makes it possible to place them at close center distances either in line or radially around a fixture. No matter what the application, you get smooth, dependable operation.

Used in drilling, counterboring, spot-facing and reaming operations, these hydraulic power units can be designed into special-purpose machines with easily controlled automatic cycles. Units can later be re-arranged to perform different machining operations.

You can install these power units easily. They'll stand up under fast cycles and continuous operation; they're self-lubricated.

For complete information ask your Ex-Cell-O representative or write Ex-Cell-O in Detroit.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

EX-CELL-O FOR PRECISION

XLO

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-45

Greatest thing that's happened since the Madison Boring Tool!

Madison-Faessler Roller-Burnishing Tool

- ***Superior Surface Finish*** — five micro-inches or better.
- ***Single Pass Operation*** — for roller-finishing bores of any length.
- ***Fast, Easy to Set Up*** — on conventional shop machines.
- ***Adjustable in Size*** — for easy-to-handle job changes.
- ***Off-the-Shelf Delivery*** — of standard tools in most popular sizes.
- ***Extra Long Life*** — thousands of passes before parts replacement.

No wonder a customer said it's "the greatest thing since the Madison Boring Tool!" If you'd like to know more about this fabulous tool, or our roller-burnishing tools for O.D. cylindrical surfaces as well as tapers and radii, just send coupon today.

Let the man with the holes in his head tell you how to cut costs in:

- ★ **Boring**
- ★ **Reaming**
- ★ **Deep Hole Drilling**
- ★ **Trepanning**
- ★ **Roller-Burnishing**
- ★ **Gaging**

MAIL COUPON TODAY

Dept. TE-3

☐ Please send me bulletin on the Madison-Faessler Roller-Burnishing Tool.

☐ Have representative call.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

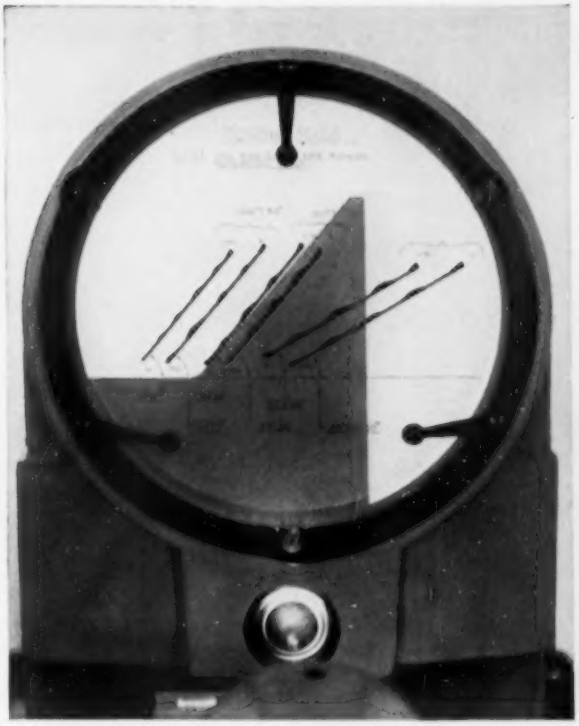
Inner Diameters Are Our Business

MADISON-FAESSLER

TOOL COMPANY *MOBERLY, MISSOURI*

ASSOCIATED WITH MADISON INDUSTRIES, INC.

1–A typical MS aircraft bolt has a radius tolerance of .031-.041 on the fillet where the head joins the shank. By placing up to 9 radius drawings on a single overlay chart, a number of machine operators can check fillets during production.



2–Another typical job at Standard Pressed Steel Company involves checking the angularity of a 100° flush head bolt to ½°. Angularity is checked at the same time that the radius is measured to .0015" (limits are .016-.019).

How Kodak Contour Projectors help keep gage inventories low in production checking

Standard Pressed Steel Company—manufacturer of aircraft bolts, socket screws, and other close-tolerance fasteners—once needed as many as 26 radius gages to check the fillets of *each type of bolt* it made while the bolts were in production.

Multiply this figure by the number of types of fasteners . . . add the gages required for checking other dimensions such as root radii—and you get an idea of the vast inventories involved in conventional inspection methods.

Now SPS does much of its production inspection by optical means with Model 8 Kodak Contour Projectors—and gage inventories have been slashed for these 4 important reasons:

- Light in weight, the Model 8's can be readily moved, used where needed on the production line.
- A single Contour Projector can serve several machine operators, since one screen chart can show tolerance limits for as many as nine different radii. (Fig. 1)
- A single chart can check several dimensions at once on a given part. (Fig. 2)
- By interchanging charts, the same Projector can be used to check a variety of parts—bolts, flat-head screws, or socket screws. (Fig. 3)

Model 8 and other Kodak Contour Projectors can help simplify your measurement and inspection problems, too. For full details write for our illustrated booklet, "Projection Gaging with Kodak Contour Projectors," or ask for the name of the Kodak field representative in your area. He'll be glad to advise you.

3–Here an operator uses a Model 8 Projector to check the root radius of threads to tolerances on the order of .002".

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

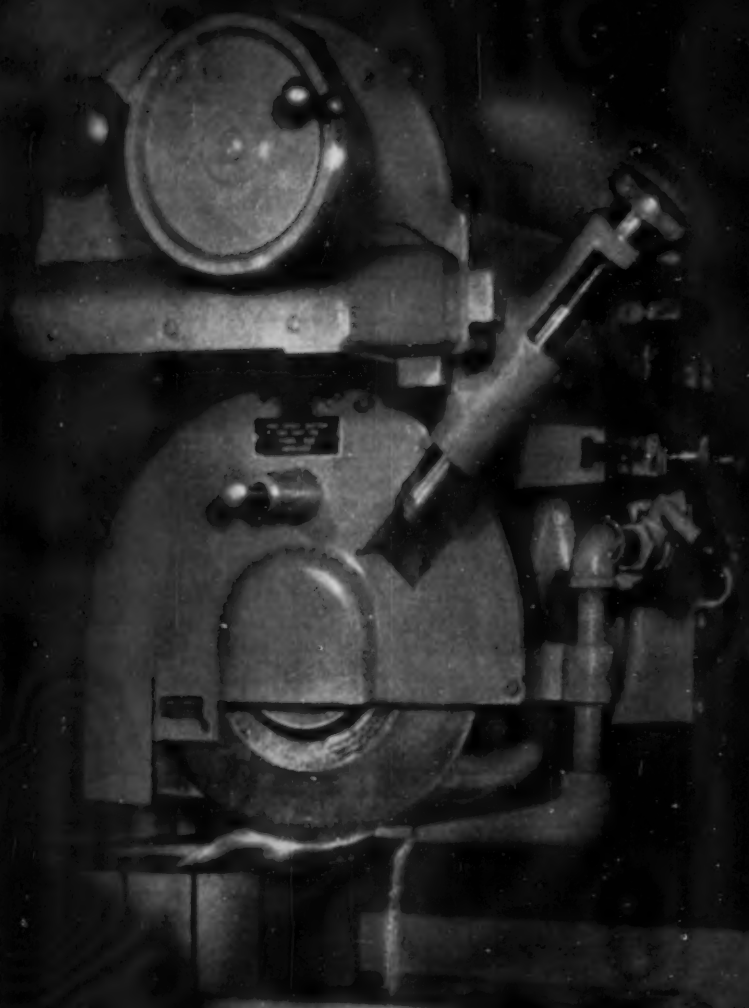
Apparatus and Optical Division

the KODAK CONTOUR PROJECTOR

Kodak

WORLD'S MOST COMPLETE LINE

# of hydraulic surface grinders



invites your attention...

name the surface grinding job... Thompson has the machine

Thompson Type B

Surface dies or parts faster to part print, at lower cost, within wide size range

work size
6" x 18" to 12" x 120"

Thompson Type F

For greatest precision, sensitivity and versatility in toolroom...or parts production at low cost

work size
8" x 18" and 8" x 24"

Thompson Type C

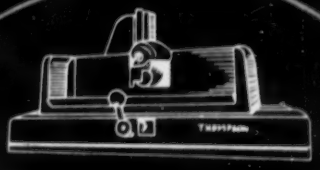
Meets production and cost demands in larger size surface work of all types

work size
12" x 40" to 24" x 168"

Thompson Type CX

Offers both power and precision for heavy duty production...fast, accurate

work size
30" x 72" to 36" x 240"



Thompson SURFACE Grinders

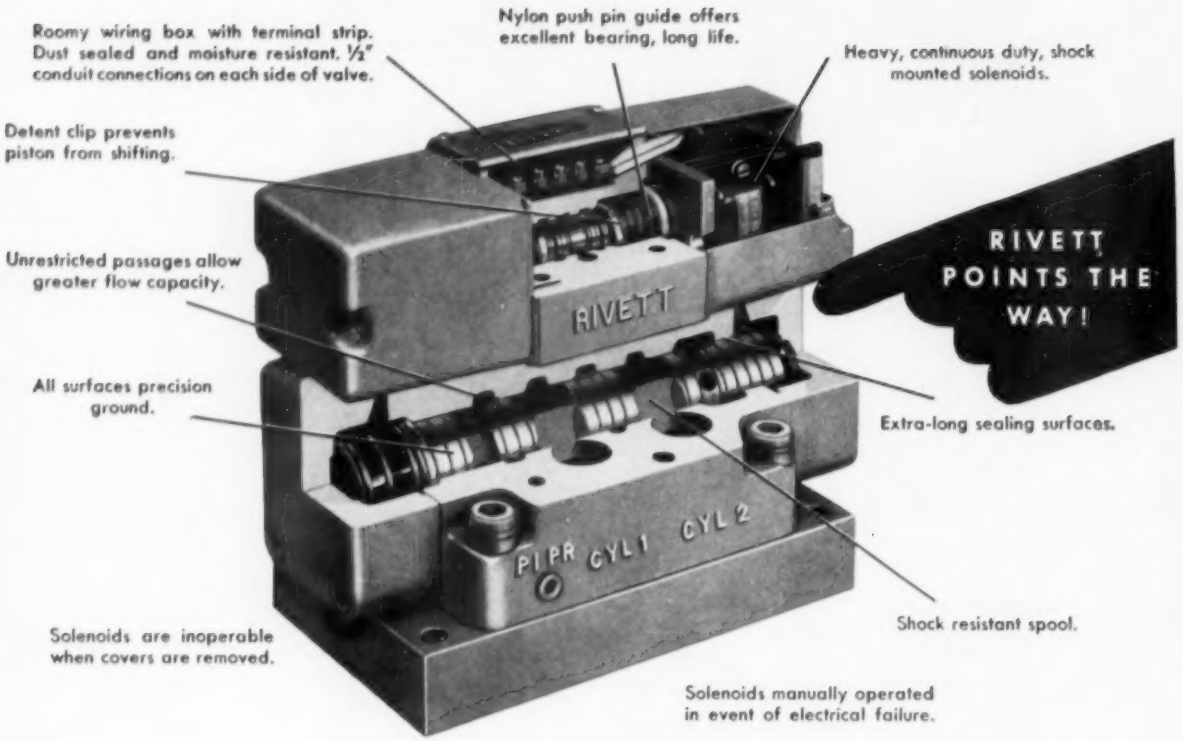
* Including a complete line of Truform, Hydrail, Hydrovert, Twin Rotary and other special grinders for all sizes and types of work.

write for descriptive data

THE THOMPSON GRINDER COMPANY

SPRINGFIELD, OHIO

Copyright 1956 The Thompson Grinder Co.


Roomy wiring box with terminal strip. Dust sealed and moisture resistant. ½" conduit connections on each side of valve.
Nylon push pin guide offers excellent bearing, long life.
Heavy, continuous duty, shock mounted solenoids.
Detent clip prevents piston from shifting.
Unrestricted passages allow greater flow capacity.
RIVETT POINTS THE WAY!
All surfaces precision ground.
Extra-long sealing surfaces.
RIVETT
P PR CYL 1 CYL 2
Solenoids are inoperable when covers are removed.
Shock resistant spool.
Solenoids manually operated in event of electrical failure.

High Flow Capacity!

Rivett's New Solenoid Pilot Operated Hydraulic 1" Valve Is Rated at 28 G.P.M. and the 1½" Size At 82.5 G.P.M., At 15 Ft. Per Sec. Velocity.

- Reduces Back Pressure, Friction, Heat
- Opens and Closes Smoothly, Positively
- Mounts In Any Position
- 3000 P.S.I. Operation for Multi-Million Cycles
- Optional: Built-in Speed Controls
  Explosion Resistant
  Solenoid Enclosures

Forget about back pressure by specifying Rivett 6600's for service up to 3000 P.S.I. Reduce inventory! Select off the shelf: 2 basic sizes fit ⅜", ½", ¾", 1", 1¼" and 1½" I.P.S. Single and double solenoid. 7 spool designs. Meet *all* J.I.C. requirements.

RIVETT, INCORPORATED • Dept. TE-4
Brighton 35, Boston, Mass.

THE BETTER YOU KNOW HYDRAULICS THE BETTER YOU LIKE

Get Catalog No. 261 to aid your circuit design. Complete drawings, specifications, cut-away views, tables, diagrams!

Member National Fluid Power Association

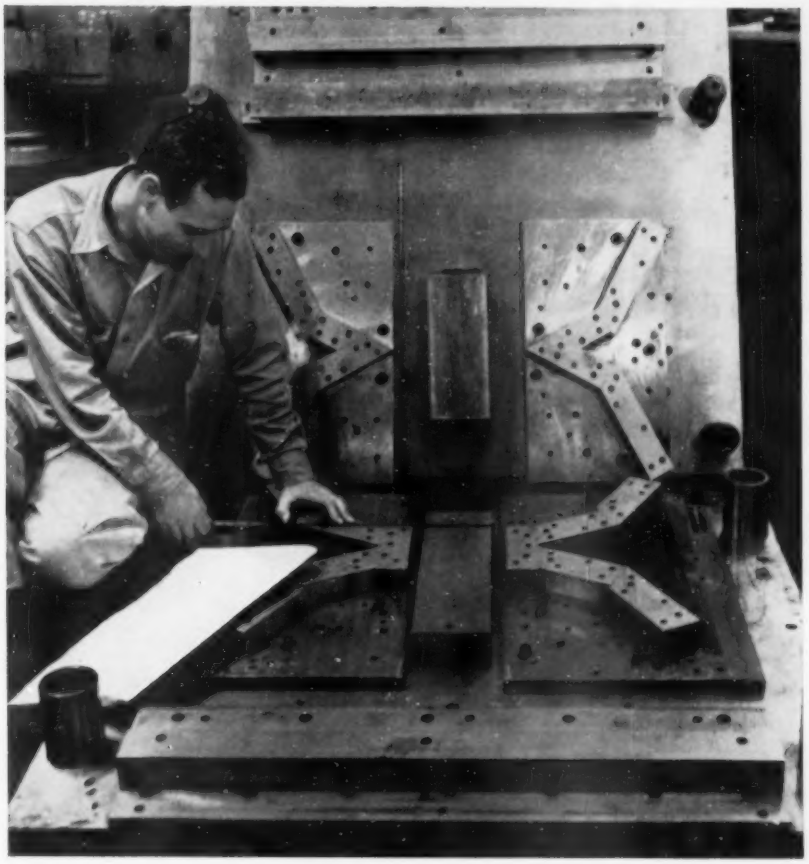
RIVETT
"100"
HYDRAULIC VALVES

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



New Equipment, With Die of Lehigh H, Ups Production of Cabinet Parts 200 Pct

The F. H. Lawson Co., Cincinnati, maker of bathroom cabinets, recently increased production of body blanks about 200 pct by installing a high-speed notching and cut-off operation, which is automatic from the coil to the body blank. It includes a 20-piece die, made of Bethlehem Lehigh H tool steel which had been supplied by Solar Steel Corp., Cincinnati.

In the new setup, a decoiler pulls 20-gage steel stock through the stretcher leveler into the Lehigh H die, where it is notched and blanked at about 50 strokes per minute. The die, hardened to Rockwell C 61, passed its first five months of service without any need for redressing.

Lehigh H is an ideal tool steel for blanking jobs and other severe applications, because of its wear- and shock-resistance, plus its high compressive strength. Lehigh H is our special-purpose high-carbon, high-chromium grade of air-hardening tool steel.

TYPICAL ANALYSIS

Carbon 1.55	Molybdenum 0.80
Chromium 11.50	Vanadium 0.40

There's probably more than one application in your shop where Lehigh H tool steel could do a real job. Why not try it? All you need do is get in touch with your local Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

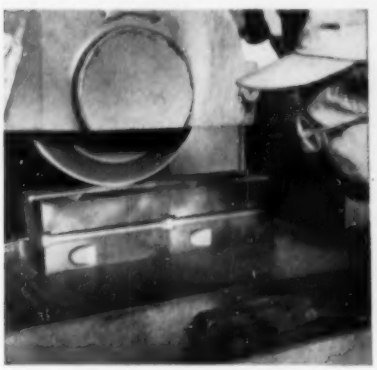
Grinding Cracks Not Always Fault of Grinder

As a rule the grinding cracks which sometimes appear during the finish-grinding of hardened tools are attributed to improper grinding practice. They can be caused by:

1. Scorching by removing metal too rapidly.
2. Dull or loaded grinding wheel.
3. Too fine a grit size.
4. Ineffective use of coolant.

But grinding technique is not always to blame. For example, a tool which has not been adequately tempered after quenching, or one that has become embrittled by an excessively high quenching temperature, may be impossible to grind without cracking, regardless of the care used in grinding.

Unless the cause of the cracking is obvious, we recommend a complete investigation. Once the source of the trouble is known, it's easy to specify the cure.



CARBON WATER-HARDENING ECONOMICAL IN HEADING DIE STEEL

This heading die is being finish-ground prior to manufacture of $\frac{5}{8}$-in. diam button-head track bolts. Hardened to Rockwell C 60, and working on C 1016 steel, it can produce about 100,000 pieces between grinds. Bethlehem Carbon Water-Hardening steel has high shock-resistance, and its controlled carbon range gives it ability to withstand the effects of wear and cold-battering. When used in cold-heading applications, the correct degree of hardenability must be supplied.

If you consume end mills the way a coffee drinker consumes coffee...

This brand cuts down your end mill usage, production time and costs!

The more end mills you use, the more you need Union

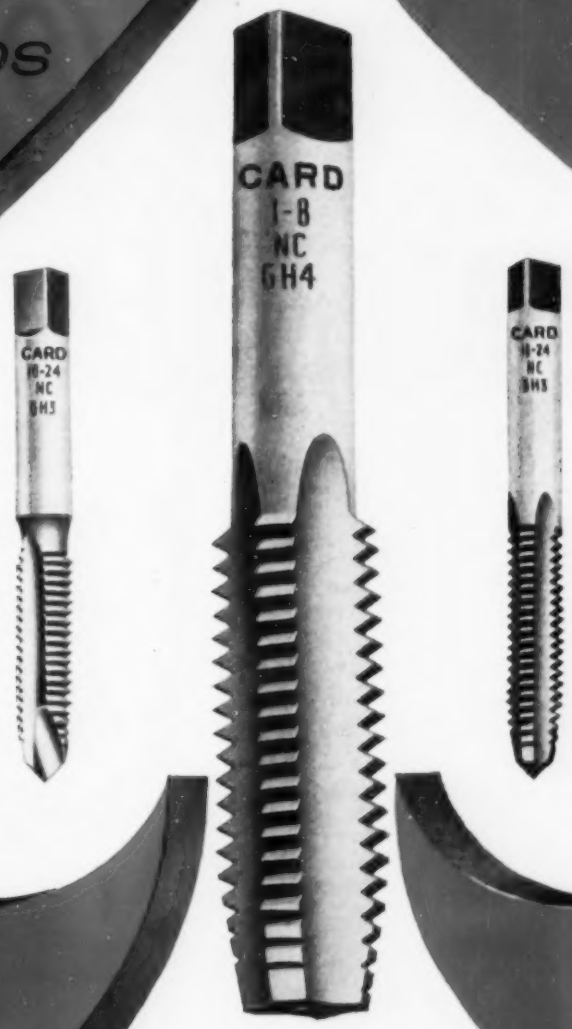
Union also manufactures drills, milling cutters, gear cutters, hobs, reamers and carbide tools. Available nationally through Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco. S. W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vt.

UNION

TWIST DRILL COMPANY, Athol, Massachusetts

See Your UNION DISTRIBUTOR for cutting tools that will save you time and money

...and in taps



CARD is

ACES with OPERATORS

Operators busy at many different tapping applications will tell you that Card taps can be depended upon for precision performance and long life — on job after job. And shopmen are sure of getting uniform top quality in gages as well as taps, every time they use these popular Card tools. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

— Serving you through fine distributors from Coast to Coast

Precision by the Truckload - - they're Blanchard ground!

This truck is loaded with 14 tons of steel. Its cargo is 33 soft steel plates, each measuring 27½" x 25½" x 11.125", and ground to ± .001" on a Blanchard Surface Grinder.

Dies up to 84" across corners, can be ground on a Blanchard at great savings. Grinding can be controlled without guesswork—leaving a flat, sharp die—as soon as the entire surface is cleaned up. Die resharpening on the Blanchard allows you to get maximum life from your valuable dies and end plates.

Ask for details on the 15 standard Blanchard models.

For best results in surface grinding . . .

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS.

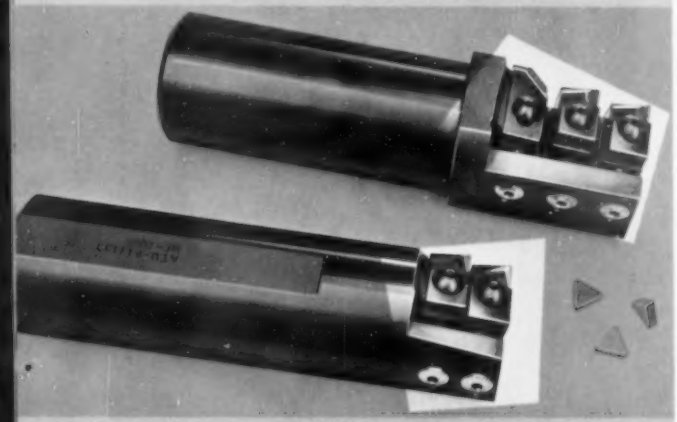
THE BLANCHARD MACHINE CO., 64 State St., Cambridge 39, Mass.

Gentlemen: Please send me a free copy of "The Art of Blanchard Surface Grinding" (3rd edition) and "Work Done on the Blanchard" (5th edition)

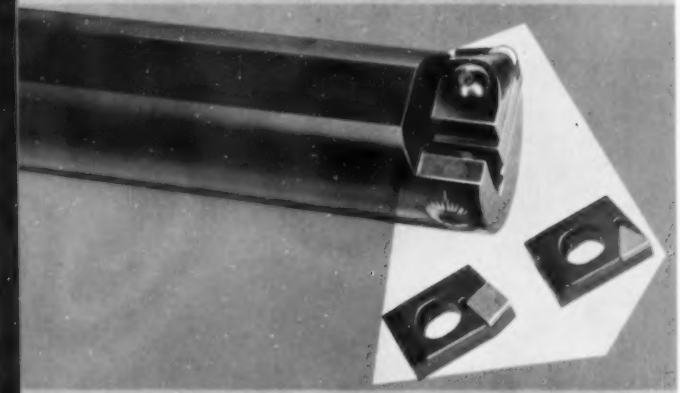
NAME_____ STREET_____

FIRM_____ CITY_____ ZONE____ STATE_____

Wesson micro-adjustable tools for combined BORING AND FACING use throw-aways for both purposes.



MULTIPLE POINT micro-adjustable boring bars for multi-diameter boring and chamfering, etc., have been added to the line. Each insert is micro-adjustable and once set, stays put.



STANDARD MICRO-ADJUSTABLE boring bars are available with interchangeable anvils for different types of inserts, maximum versatility and maximum adaptability to different jobs.

WHAT THEY SAY ABOUT WESSON MICRO-ADJUSTABLE BORING TOOLS

"We've cut boring down-time for tool changes over 90% and cut tool costs from $35 to only 22 cents per 1000 pieces."

"So good, we are now using micro-adjustable boring bars in place of single point turning tools, cutting tool costs, scrap and down-time."

"Micro-adjustable boring bars with throw-aways have cut tool costs on one operation from $13,800 per year to only $1036."

carbide

Revolutionary WESSON tools uncover and cut hidden costs and scrap, improve finish

Micro-Adjustable Boring Bars With Throw-Aways Sweep Industry

Announced barely six months ago, the Wesson line of micro-adjustable boring bars designed specifically for the use of throw-away inserts has taken metalworking by storm, replacing conventional boring tools, reamers, single point tools, and multiple point boring tools in scores of applications. They are even being used for OD turning.

So general has been the acceptance and so broad the demand that the Wesson line of micro-adjustable boring tools has been expanded to a wide range of types, both standard and special. Shown here are just a few of the styles now in use in industry.

Wherever they have been applied they have shown tremendous savings in tool cost, greatly reduced machine down-time for tool changes, and minimized scrap due to boring tool adjustment. Largely contributing to this end are:

MICRO-ADJUSTMENT, an exclusive Wesson feature which provides a positive adjustment for diameter of 0.001 inch for every graduation of the screw-head dial.

ELIMINATES GRINDING of tools. THROW-AWAY inserts permit from 6 to 10 indexes to new cutting edges before discarding the insert.

LOW COST of inserts, greatly reducing outlays for consumption tooling.

(continued on page 2)

Micro-Adjustable Boring Bars

(Continued from page 1)

STANDARD PARTS used wherever possible to permit interchange between different boring tools, reduced inventories, etc.

CHIP CONTROL—complete with built-in adjustable chip breaker, making tools equally adaptable to long and short chip work.

LONG LIFE per tool change. In practically every case, pieces per cutting edge are higher than previous tool performance without any change in speeds, feeds or cuts.

A complete new Wesson brochure covering these boring tools has been prepared. Ask for Catalog #MB-157.

Newest No-Skill Grinder

Improved model of Wesson's Poweramic Grinder which automatically produces hone-like tool finishes at low cost in less time. It protects the tools against faulty grinding. Practically no skill is needed. Among the features responsible is Wesson's exclusive Tru-Arc grinding principle. Ask for Bulletin #PG-157.

tools Wesson carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 JUDGE ROAD, TORONTO 18, ONTARIO

TABLE 1		
	BEFORE	AFTER
Tool used	2-bladed Reamer	Micro-adjustable boring bar
Carbide used	C-6	Wesson WH
Cutting speed, rpm	155	155
Feed rate per revolution	.012 ipr	.012 ipr
Machining time	(cycle unchanged)	
Tool change time	4 minutes	60 seconds
Pieces per tool change	100	400
Pieces per blade or insert, total	400	3200
Grinding cost, each	$0.875	None
Total grinding cost per tool	$3.50	None
Initial tool cost	$11.50	$0.72/insert
Total cost per 1000 pieces	$37.50	$0.22
Total tool change down-time per 1000 pieces	40 minutes	2½ minutes

Throw-Away Boring Tool Gives Better Finish Than Reaming and Cuts Tool Cost 90%

Wesson's micro-adjustable boring bars with square throw-away inserts replaced two-bladed carbide reamers in an automotive transmission plant with the following results, without change in output rate:

1. Down-time for tool changes cut over 90%.
2. Finish improved.
3. Consumption tooling cost reduced from $35 per 1000 pieces to 22 cents per 1000 pieces.
4. Reduced tool inventory.

The parts are pearlitic planet pinion carrier housings of about 200 Brinell. Reamer output was 100 pieces per grind. This jumped to 400 pieces per cutting edge for the throw-aways. The number of shut-downs for tool changes was cut 75% and shut-down time per change also cut 75%. Net gain well over 90%.

Micro-adjustment is required only for initial setup. After that, simple indexing insures accurate adjustment. Inserts are of Wessonmetal WH.

PLANING WITH "THROW-AWAYS"

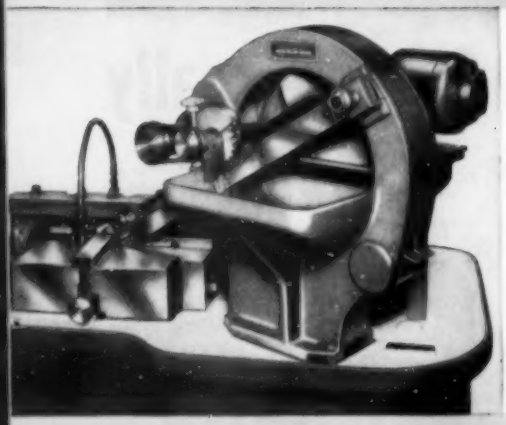
The planing operation shown here forecast some years ago that throw-aways were coming. It shows a Wesson MX-9 Multicut holder with a throw-away insert of Wesson's broad-range Grade 26 steel cutting grade, taking a ¾-inch depth of cut without any trouble on mill plate at 200 feet per minute. Planing is another of the big fields served by Wesson "No-Grind" tool holders and indexable inserts. Ask for Catalog #5510-M.

LITHO IN U.S.A.

SCREWS or NAILS THREADED

with Hartford Special Automatic Thread Rollers

- **Diameters from .086 to .3125"**
- **Thread lengths from ⅛ to 2½"**
- **Large capacity hopper reduces refill time**
- **Positive positioning and feeding of blanks**
- **Variable bucket speeds**
- **Roll Class 3 Thread Fits**
- **Wired to J.I.C. Standards**



SPECIFICATIONS
MODEL A-190-R

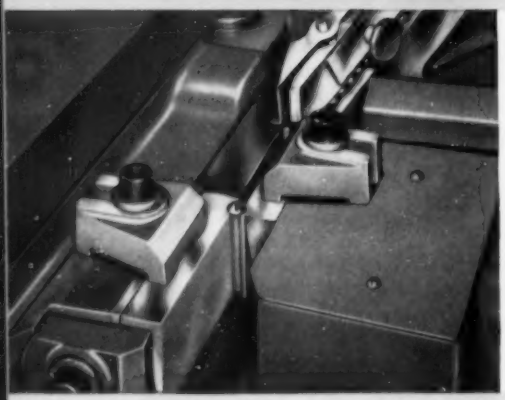
Screw Diameter Capacity: Machine Screw Sizes from #2 (.086) to #10 (.190)

Thread Length Capacity: ⅛" to 1½" with standard depth dies; 2" with special depth dies

Production Rate: 230 to 250 pieces per minute

Machine Dimensions: Length, 42"; Width, 26"; Height to table, 33"; Height overall, 52"

Floor Space Required: 4' x 5' approximately



SPECIFICATIONS
MODEL A-312-H

Screw Diameter Capacity: Machine Screw Size #6 (.138) to ¼"

Thread Length Capacity: ⅛" to 2" with standard depth dies; 2½" with special depth dies

Production Rate: 80, 100, 120 or 140 pieces per minute dependent on screw size

Machine Dimensions: Length, 62"; Width, 39½"; Table Height, 36"; Overall Height, 63½"; Hopper Loading Height, 53"

Floor Space Required: 4'x6', approximately

Hartford's line of automatic Thread Rollers can accommodate all types of machine screws, sheet metal screws, drive screws, wood screws, nails and screwnails. They will also knurl, burnish or groove, and can handle specials as well.

These high production machines are equipped with a filtered lubrication system. They are vibration-free even at top speed. They are ruggedly designed, and engineered to provide "table-top" working level to reduce operator fatigue.

Write for Bulletin TR-102 for complete information.

Hartford Special also makes Drilling and Tapping Machines, Machine Components, Special Machines and the world famous Super-Spacer.

HARTFORD Special

MACHINE TOOL ACCESSORIES DIVISION
THE HARTFORD SPECIAL MACHINERY CO.
2804 HOMESTEAD AVENUE HARTFORD 12, CONN.

Automatic Skin Drilling Machine

To replace costly, slow hand methods, Grumman Aircraft Corporation designed and fabricated the "skin drilling machine" shown here.

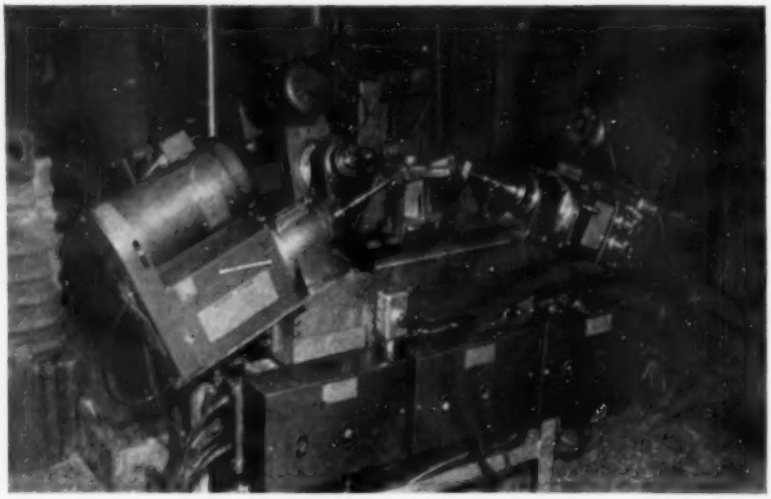
The production requirement was—9000 holes in aircraft skin assemblies consisting of aluminum corrugated section and skin. Formerly, all holes were predrilled by hand in the corrugations and then transfer drilled into the skin. Now, hand work is reduced to tack riveting skin and corrugation and for a few inaccessible areas.

Operation

This new machine clamps the workpiece to prevent burring, drills #40 holes usually 5/8" apart and indexes automatically to next position. A chain and sprocket 1 H.P. drive, regulated by template and photo-electric controls, moves the drill head and lower ram assembly along parallel rails from hole to hole. The workpiece remains stationary. Row on row indexing is done by an air driven gear and rack assembly. 50 to 55 holes per minute, or about four hours per assembly, are now achieved.

Savings

In addition to the remarkably high time savings of 7½ hours per workpiece, other benefits include reduced jig time and number of jigs, extended drill life and the elimination of operator strain. The drill head used is a Dumore 20-011, self-contained with a rotary vane compressor. This is but one of the many automatic drill units made by Dumore for automation purposes. For complete information, write The Dumore Company, 1310 Seventeenth St., Racine, Wis.



Drill and Tap Automatically with this 2-in-1 Tool

the New DUMORE Series 28 "DRILL-N-TAP" UNIT

Saves Set-Up, Fixture and Service Costs

One of the world's largest farm implement makers, Massey-Harris-Ferguson, uses three new Dumore "Drill-N-Tap" Units to cut costs and increase production on power take-off housings. These units *automatically drill and tap* three holes in two sizes of housings without changing position on the same set-up. A 1"-thick steel plate is placed under the smaller housings for aligning to proper position. Here, the drilling and tapping are done on the same fixture. Drill bushings are simply removed when tapping. *Tap fits into chuck—no extra tapping head is required!*

The Dumore "Drill-N-Tap" Unit is a *driller* and a *tapper* — all in the same automatic machine. Two tools in one — at the cost of only one!

It drills or taps without attachments — no long overhang, or expensive clutches to wear out. Self-reversing motor, electrically controlled, withdraws tap by reversing spindle rotation. You drill or tap *at the flip of a switch!*

Mounts in 3 minutes — anywhere — on job after job for long or short production runs. It doubles the output of ordinary methods with less tool breakage and scrap losses. Simple nose mounting device provides easy installation on less table area. Work mounts close to fixture with little tool travel for faster cycling, less idling time. 10 speeds from 265 to 4900 rpm.

GET A DEMONSTRATION NOW. . . SEE YOUR DISTRIBUTOR, OR WRITE

YOU CAN DO MORE WITH DUMORE DRILL UNITS

DRILLING • TAPPING • BORING • MILLING • FACING • REAMING • CHAMFERING • DEBURRING

DUMORE PRECISION TOOLS ®

AUTOMATIC DRILL UNITS
TOOL POST AND
HAND GRINDERS

1310 Seventeenth St., Racine, Wis.

PRODUCTION MACHINERY

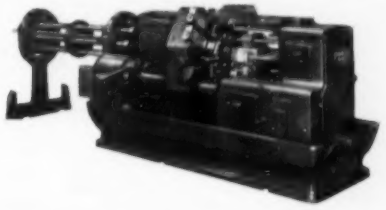
GREENLEE

AUTOMATIC BAR MACHINES

HELP YOU BEAT RISING PRODUCTION COSTS

The cowman achieves speed and power in a good "using" horse by years of careful breeding . . . Greenlee develops these same qualities in its Bar Automatics by continuous research and design improvement. One of the many superiorities of this speed and power is that it enables you to take full advantage of modern tooling practices. Your Greenlee representative will be glad to show you how it is done. Please submit print when inquiring about a specific job.

Write for Catalog No. A-405



SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES

GREENLEE Special Machine Tools

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

GREENLEE
BROS. & CO.

1984 MASON AVE.
ROCKFORD, ILL.

The world's most accurate

Now distributed in the United States and Canada by Jacobs and your Jacobs chuck distributors

The Albrecht Heavy Duty Drill Chuck

- Keyless construction
- Excellent gripping power
- Self tightening — smooth release
- Very high accuracy
- Drill breakage minimized
- For tool room and the production line

The Albrecht Heavy Duty Drill Chuck is available in 11 taper back models in capacities up to ⅝". This is a keyless, self-tightening chuck of exacting accuracy.

The Albrecht Small Drill Chuck Model No. 15 JO

Model 15 JO is especially designed for small diameter drills. It has a maximum capacity of 1/16" and a minimum well under the No. 80 drill. Like the heavy duty models, No. 15 JO is keyless, and self tightening.

The superlative performance of this precision chuck is now available to you through your Jacobs industrial supply distributor. He is backed up by replacement parts stocked in the United States, plus the finest service facilities anywhere.

Call your Jacobs industrial supply distributor for full details and your copy of the new Albrecht catalog.

keyless drill chuck

Close tolerance drilling easily accomplished on a tool room milling machine.

Get the finest performance from your jig borer with the world's most accurate keyless drill chuck.

Albrecht Chucks are ideal on milling machines and jig borers

The Albrecht Keyless Chuck is ideal for use on high speed sensitive drilling machines.

The Albrecht Small Chuck, Model 15 JO, is the finest keyless chuck available for accurate drilling of the smallest holes.

Close tolerance drilling on high speed drill presses

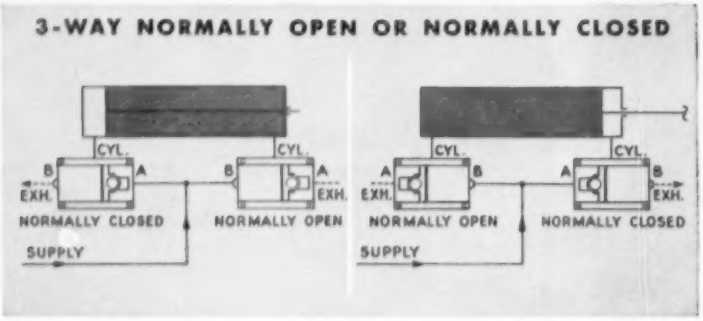
Jacobs CHUCKS

The Jacobs Manufacturing Co. • West Hartford, Connecticut

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-59

Simplified piping

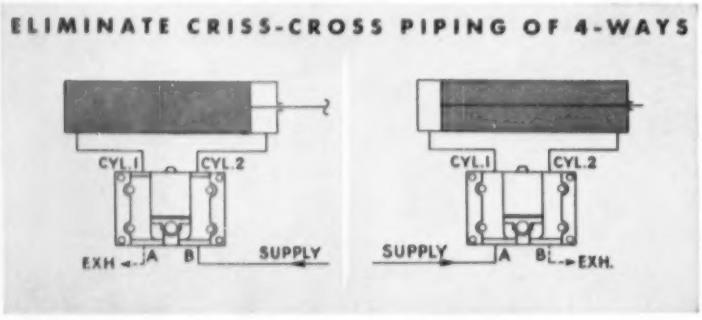
Another Plus Value in NOPAK-MATIC poppet-type air control valves



Simply pipe to proper port . . . no change in valve necessary

Piping supply to Port "A" provides Normally Closed operation — supply to Port "B" Normally Open operation. There are no changes to make in the valve . . . just pipe to the proper port. All 3-Way valves have two cylinder outlet ports for piping convenience.

The exclusive Nopak-matic "Flow-Director" pilot head automatically selects pilot pressure from whichever port is used as inlet. It eliminates purchasing special valves for each application or re-assembling of parts.



Simply pipe to proper port . . . no change in valve necessary

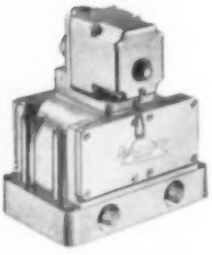
All Nopak-matic 4-Way valves can be piped with pressure to Port "A" or Port "B". Here again, the "Flow-Director" pilot head automatically selects pilot pressure from the inlet port. Flow through the valve is thus changed to meet the application requirements . . . eliminates criss-cross piping to the cylinder. There are no changes to make in the valve . . . just pipe to the proper port.

NOPAK-MATIC Plus Value Valves are available in ¼", ⅜", ½" and ¾" pipe sizes, for 2- or 3-Way Normally Open or Normally Closed operation with master (air), single or double solenoid pilot control heads.

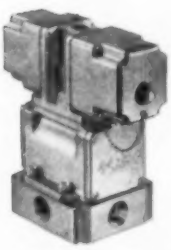
300 SERIES
2,- 3-Way
Master Valves

400 SERIES
4-Way
Master Valves

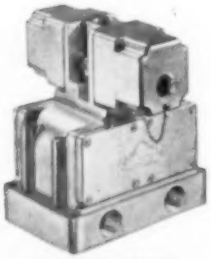
310 SERIES
2-, 3-Way
Single Solenoid
Pilot Operated



410 SERIES
4-Way
Single Solenoid
Pilot Operated



320 SERIES
2-, 3-Way
Double Solenoid
Pilot Operated



420 SERIES
4-Way
Double Solenoid
Pilot Operated

NOPAK-MATIC valves meet *all* J.I.C. Standards

NOPAK VALVES and CYLINDERS

GALLAND-HENNING NOPAK DIVISION • 2750 South 31st St. • Milwaukee 46, Wis.

Catalog 105 describes in detail all the Nopak-matic Plus Values and gives complete dimensions, installation and parts data. Send for your catalog now. It will be forwarded promptly.

A 6-605-1P

"TRUKUT® increased production 4 times..."

A small Mid-Western machine shop was confronted with an economic problem – production costs were too high – tool life was too short. While engaged in the job of cutting threads on 1020 16-gage electric welded steel tubing, the shop called in Sinclair Representative Raymond F. Ohm for help.

Mr. Ohm reports: "Tool life was a maximum of only 100 pieces before burning took place. Thread was very rough, due partly to chatter because of thin wall of tube."

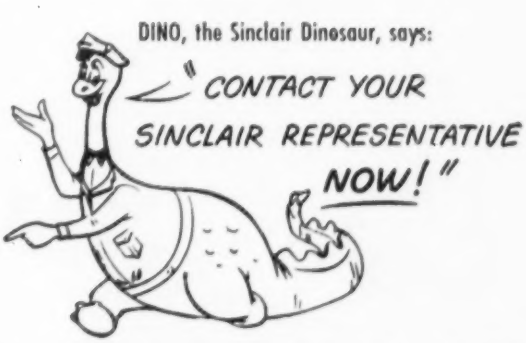
"I recommended Sinclair TRUKUT® EP Soluble Oil, Grade C, because it affords greater emulsion stability, longer tool life and better finishes with close tolerance. It also gives a greater cooling and load-carrying capacity to prevent tool welding and burning."

"With TRUKUT, *production has been increased four times.* Four hundred or more pieces are produced before tool is replaced. Also – finish of threads is finer, and general appearance of the finished piece is better."

"The shop found TRUKUT EP, Grade C, so satisfactory that it now uses TRUKUT exclusively."

If *you* have a problem with cutting or grinding coolants, it will pay you to look into the advantages of Sinclair TRUKUT EP Soluble Oils. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

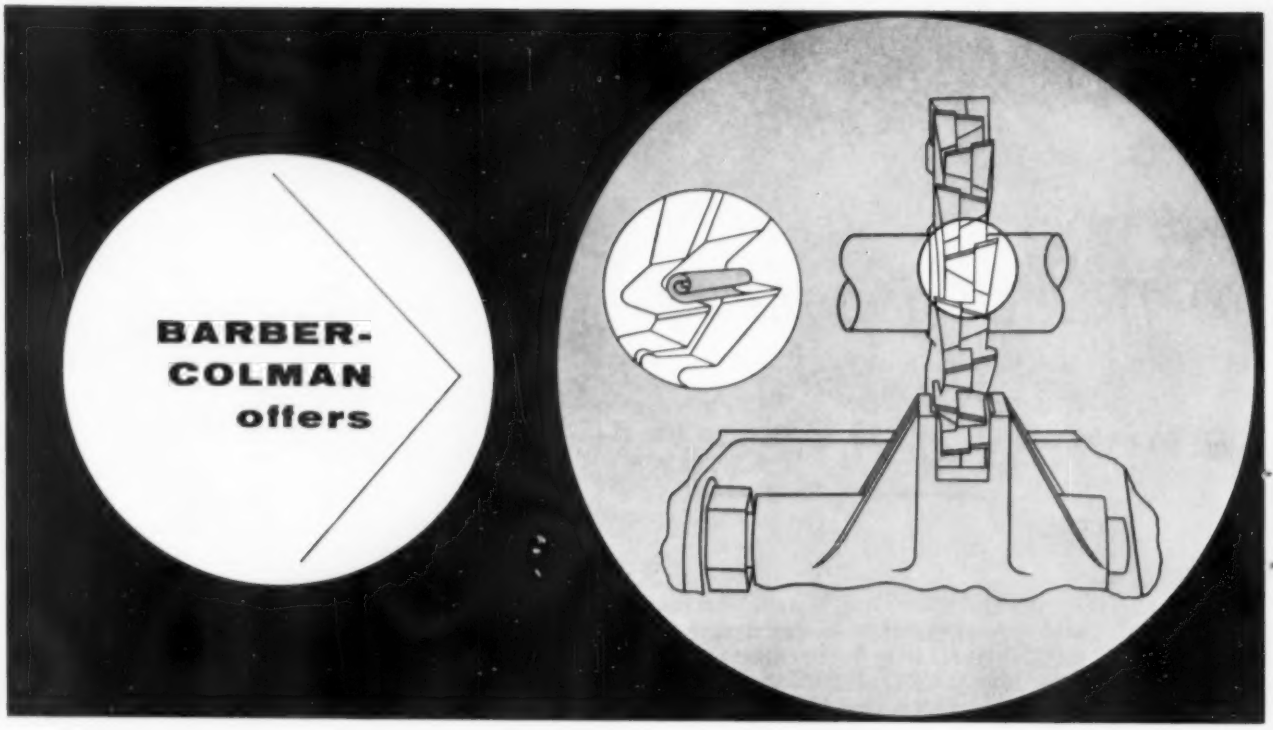
DINO, the Sinclair Dinosaur, says:



SINCLAIR

CUTTING OILS and COOLANTS

top cutter design
improves
cutting efficiency and
tool life



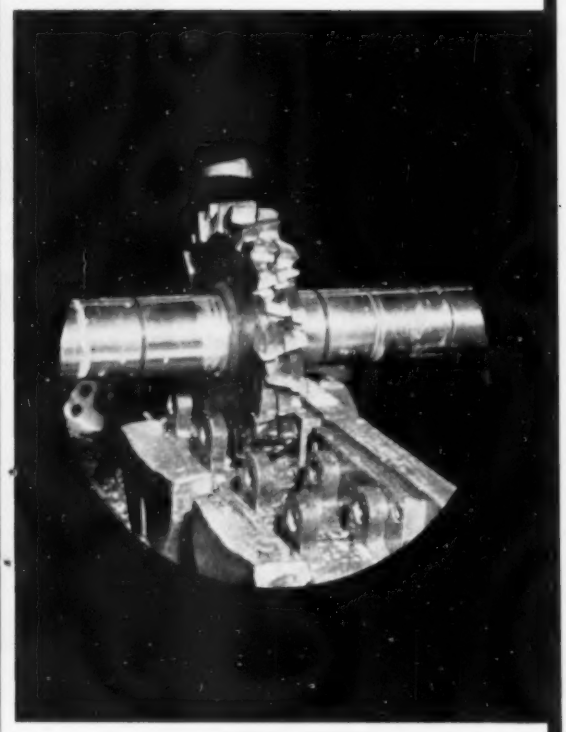
free-flow of chips across cutter face for reduced tooth breakage and increased feeds and speeds*

Improved performance and tool life are provided by these Barber-Colman interlocking staggered-tooth side milling cutters* because chips flow freely across the face of the cutter teeth. The patented interlock of the teeth provides that the entering section of the tooth in the cut is always slightly ahead of the trailing portion so that there is no chance of piling up chips or blocking chip flow. Consequently, these cutters increase tool life and permit the use of greater feeds and speeds.

Cutters of this type are recommended for long deep slotting cuts in steel, shoulder cuts and for milling operations where depth of cut exceeds the width of the cutting face. They work equally well in steel or soft non-ferrous materials. The interlocking feature provides adjustment for accuracy and longer cutter life.

The operation shown here is milling a flywheel clutch cam at Caterpillar Tractor Co. A slot 1″ long x 1⅛″ wide x 1³⁄₁₆″ deep is milled, removing .096″ stock from sides and bottom of cut.

* Patent No. 2,230,662



Compare these figures with operations in your shop:

Part.....Steel Forging, 241-285 Brinell
Cutter Speed.....54 sfm
Cutter Feed.....3.2"/min.
Pieces per Hour.....43
Pieces per Sharpening...344

increases feeds and speeds

Feeds and speeds which could stall conventional type cutters can often be used with this cutter design. The depth of cut may be as great as the depth of the cutter hub without impairing the efficiency of the cutters. Absence of chip accumulations reduces cutting temperatures to allow increased feeds and speeds.

lengthens tool life

This improved design eliminates any obstruction to the free flow of chips across the cutting face. Consequently, chip congestion found on cutters of conventional design is eliminated. Because of this chip action, cutting edges will produce many more pieces per sharpening. The absence of chip congestion also removes a major cause of tooth breakage.

guarantees accuracy

Through the interlocking feature, accurate slots can be milled throughout the life of the cutters. The width of conventional cutters becomes undersize with sharpening and they must be discarded or used for other work. The width of interlocking cutters, however, can be accurately controlled throughout the life of the cutters by using shims between the sections. Several widths of slot can be milled with the same interlocking cutter by using shims of varying thickness.

These special cutters are only one example of Barber-Colman cutter design, specifically suited to particular job requirements. When you have milling problems, consult Barber-Colman Cutter Engineers for recommendations. Send us blueprints or a trial order for your special cutter requirements. Get top cutting efficiency through top cutter design.

BARBER-COLMAN COMPANY

884 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

VASCOLOY-RAMET PRESENTS . . .

VR-

NEW VR-75 quality carbide is a vacuum sintered steel-cutting grade developed specifically for use where high heat is generated. On such work, it will out-perform any grade of carbide available today

AVAILABLE NOW

In throw-away and long inserts for negative rake toolholders

VR-75 is an addition to the standard line of V-R quality steel-cutting carbides which meet 80% to 90% of all steel machining requirements. On applications where severe heat and shock conditions are a problem, new VR-75 is the thoroughly field-proven answer. It is ideally suited to heavy turning, facing, boring and milling jobs where coolants are not used . . . and will also give excellent results on a great many general steel machining operations.

VR-75 gains its exceptional heat resistance, high edge strength and high shock resistance from the special blending of tungsten carbide, titanium carbide, tantalum carbide, columbium carbide and cobalt. Maximum performance is assured by its grain structure and exceptional purity. Vascoloy-Ramet's exacting quality control procedures assure a constant, superior, uniform product.

In the history of the carbide industry, there has never been a higher quality product than new VR-75 steel cutting grade.

For complete information, call your local V-R representative or distributor, or write.

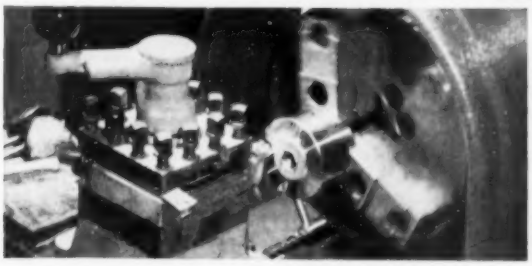
SEND FOR NEW BULLETIN . .
Get complete facts about this cost-cutting carbide today.

VR-75

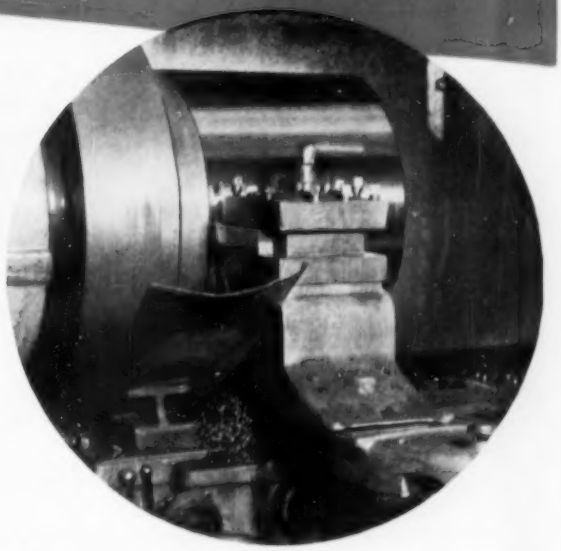
A SUPER STEEL-CUTTING CARBIDE GRADE

NEW VR-75 HAS

- High heat resistance
- High shock resistance
- High edge strength



VR-75 Has Set Performance Records on Jobs from 1" to 36" Diameter



New VR-75 will increase production . . . minimize downtime . . . and drastically reduce tool costs on rough jobs like these:

- Wheel turning
- Roll turning
- High speed milling
- Crankshaft cheeking

. . . and many others.

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

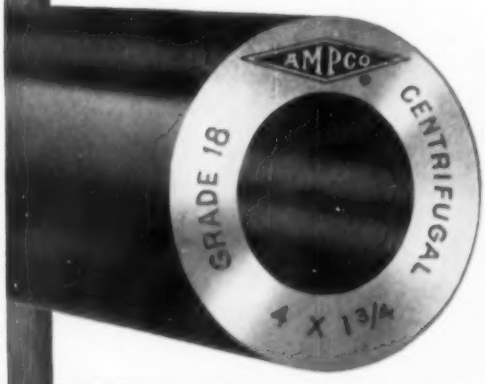
894 Market Street • Waukegan, Illinois

MANUFACTURERS OF: CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Now semi-finish machined all over

to save your machining time and reduce waste

AMPCO METAL GRADE 18 CENTRIFUGALLY CAST STOCK BARS



Ampco Grade 18 Stock Bars are now labeled on one end, for convenience in stocking. Labels show I.D. and O.D. sizes to which bars finish.

14 New Sizes! Sizes now range from 1¼" to 8" I.D., 1¾" to 10" O.D. 12½" lengths.

Purchasing Simplified! Stated sizes are now the sizes to which bars will finish.

New Convenience! Finish allowance, 1/16" on the diameter, both O.D. and I.D. You need make only finish-machine cuts.

Same Dependability! Ampco Metal Grade 18 is a unique aluminum-bronze alloy that resists wear, withstands shock and impact, lasts many times longer than ordinary bronzes. Ideal for bearings, bushings, gears, other parts.

Stock the sizes you ordinarily use in maintenance and tooling — and get other sizes promptly from your nearby Ampco stocking distributor.

Write today for new stock list.

AMPCO METAL, INC.

Dept. TE-4
Milwaukee 46, Wis.
West Coast Plant
Burbank, California

D-589

SHEFFIELD ELECTRONIC INSTRUMENTS ASSURE HIGHER PRECISION IN YOUR GAGE LABORATORY

ACCUTRON COMPARATOR

Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000, 10000/20000, 20000/40000.
Vertical capacity: 5¼".
Gaging pressure (oz.): 2—4—8—16—40.

ACCUTRON LEADCHEK

Amplifications (Dual): 1000/2000, 2500/5000.
Capacity: 10" dia.—36" long. Micrometer dial graduated to "tenths".

ACCUTRON GAGE BLOCK COMPARATOR

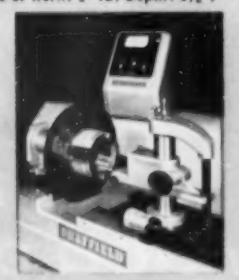
Amplifications (Dual): 10000/20000, 20000/40000, 50000/100000. Capacity: 0"—4".
Gaging pressure (oz.): 2—4—8—16—40.

ACCUTRON INTERNALCHEK—MODEL N-7

Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000.
Gaging dia.: .370"—12".
Gaging depth: 1½".

ACCUTRON RING CHECKING INSTRUMENT

Amplifications (Dual): 1000/2000.
Min. size of work: 1" ID. Depth: 5½".



ACCUTRON INTERNAL DIMENSION GAGE

Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000, 10000/20000,
Capacity: 4¼"—36¼".

ACCUTRON AMPLIFIER AND ELECTRO-JET PICK-UP UNIT

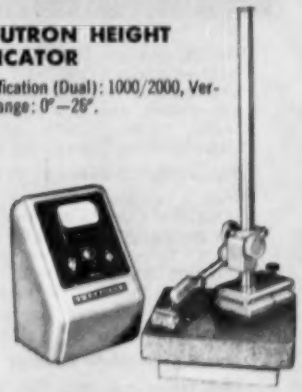
Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000, 10000/20000, 20000/40000, 50000/100000.

ACCUTRON HORIZONTAL EXTERNAL COMPARATOR

Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000, 10000/20000.
Gaging capacity: Up to 6".
Gaging pressure (oz.): 2—4—8—16—40.

ACCUTRON HEIGHT INDICATOR

Amplification (Dual): 1000/2000, Vertical range: 0"—26".



For Detailed Information on any of these instruments, write to the Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 19.

MICRO-HARDNESS TESTER

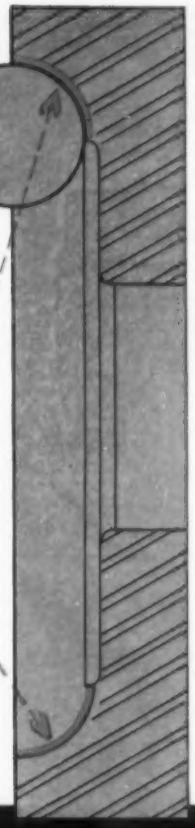
Vertical capacity: 2⅛".
Vice capacity: 1 1/16".
Microscope magnifications: 200 x and 400 x.

the SHEFFIELD corporation

...measurement for mankind

7715

If you have a **heat-treating** job like this



You need an **Induction Heating Machine** like this

New TOCCOtron Machine 50 kw 500,000 cycles

For many years TOCCO has led the Induction Heating Field—manufacturing both motor-generator and vacuum tube oscillator type machines to meet every induction heating requirement. This new 50 KW TOCCOtron unit is a big brother to the 25 KW unit which has been serving the Metal-Working Industry for many years.

Here's What It Does

With a frequency range of 350,000 to 600,000 c.p.s. the TOCCOtron unit is ideal for surface hardening small diameter parts to shallow depths (as the bearing race illustrated above), through hardening or annealing small sections and soldering or brazing small assemblies where the heating effect must be very strictly localized.

The greater capacity of the new 50 KW TOCCOtron *doubles* production rates formerly achieved by TOCCOtron equipment.

A Really Complete Machine

This radio frequency unit is a truly complete induction heating machine. It contains not only all the direct current supply components and the oscillator components, but also all the control components required for either single or two station operation.

Among the standard features of the 50 KW TOCCOtron are:

1. The industrial heavy gauge steel cabinet which completely encloses all high potential circuits preventing radiation interference and personnel hazards.
2. Meters in all sensitive circuits to enable the user to obtain the maximum output and efficiency.
3. 3-phase quadrature filament excitation of rectifiers for maximum life.
4. Externally adjustable grid bias and drive control for ease in setting up new production runs.
5. Externally mounted circuit breaker and disconnect located so that it is easily accessible.
6. Tapped plate transformer allowing variations of plate voltage.

If your operation requires the hardening, annealing or brazing of very small parts in very big quantities the new 50 KW TOCCOtron can do the job better, faster and at lower cost than any other method available.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today— NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept: G-4, Cleveland 5, Ohio

Please send catalog G showing TOCCO Induction Heating Equipment from 60 to 600,000 cycles.

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

Officers

Howard C. McMillen
President
Bedford, Ind.
Harold E. Collins
Vice-President
Houston, Texas
George A. Goodwin
Vice-President
Dayton, Ohio
Wayne Ewing
Vice-President
Los Angeles, Calif.
H. Dale Long
Vice-President
Chicago, Ill.
John X. Ryneska
Treasurer
Lynn, Mass.
William Moreland
Secretary
Ashland, Ohio
Harry E. Conrad
Executive Secretary
Detroit, Mich.
Allan Ray Putnam
Asst. Executive Secretary
Detroit, Mich.

Board of Directors

H. C. McMillen
Bedford, Ind.
G. Ben Berlien
Oakland, Calif.
I. H. Buck
Dallas, Tex.
H. E. Collins
Houston, Texas
Wayne Ewing
Los Angeles, Calif.
G. A. Goodwin
Dayton, Ohio
H. Dale Long
Chicago, Ill.
P. R. Marsilius
Bridgeport, Conn.
Wm. Moreland
Ashland, Ohio
H. B. Osborn, Jr.
Cleveland, Ohio
J. L. Petz
Poughkeepsie, N. Y.
J. X. Ryneska
Lynn, Mass.
L. C. Senger
Salt Lake City, Utah
C. M. Smillie
Detroit, Mich.
W. A. Thomas
Windsor, Ontario

Editorial Committee

G. Ben Berlien,
Chairman
Oakland, Calif.
Donald E. Zierk,
Vice-Chairman
Baltimore, Md.
Harold W. Hagle
Wesleyville, Pa.
Joseph L. Petz
Poughkeepsie, N. Y.
Harold Sullivan
Minneapolis, Minn.
Leo Tarasov
Worcester, Mass.
Donald E. Wernz
Dundee, Ill.

The Tool Engineer

The New Broom

A revitalized leadership has been given the task of managing our Society according to annual custom. This new leadership brings new ideas and enthusiasm to be blended with the tempering effect of the more experienced. This is the way we progress. Let's not be too disturbed if new ideas are proposed once in a while. It has been said that "nothing in progression can rest on the original plan."

I have had a wonderful experience this past year as your president. Space does not permit adequate praise of all who have helped. The Chapters with their enthusiastic acceptance of the Twelve-Month Plan met that challenge with far-reaching results. National Committees worked with dedicated purpose in their respective areas. The National Officers grasped the Society's problems with new understanding and with management skill kept the various activities in proper balance. Headquarters, headed by our able Executive Secretary, was the hub around which Society business and planning revolved. Thanks to all for their splendid cooperation!

There are still many problems for our "new broom" to study and solve. How best to serve our members, industry and society as a whole will always remain the basic challenge. Next year at this time, we will again proudly recognize new marks of high accomplishment. Best of good luck to our new leadership.

H. C. McMillen

IMMEDIATE PAST PRESIDENT

Machining Costs Cut 25%
by switch to NEW RYCUT 50

Logan Engineering Co. report shows how you can save up to 30% with a Ryerson leaded alloy

THE PROBLEM—This Chicago manufacturer of precision lathes faced a tough production problem from a time and cost standpoint. Lathe spindles have to be tough and hard with high wear resistance—so the steel Logan originally used was SAE 52100.

But the spindles were turned down and center-drilled from the solid to hole sizes as large as 1⅜". And ID's had to be accurate and free from scoring along the entire length of the spindles. 52100 provided the required mechanical properties but was slow cutting and created production difficulties and a high scrap rate.

Needed: A *free-machining* steel that would develop the high hardness levels, the toughness and wear strength required for the application.

THESE LARGE ALLOY STOCKS . . . also carbon and stainless steels in every shape and size, are in stock at Ryerson. Also call Ryerson for reinforcing steel service, industrial plastics, machinery and tools, etc.

THE SOLUTION—Logan engineers had long been on the lookout for a steel that would solve their production problems so they were eager to try New Rycut 50 when this Ryerson 50-carbon alloy steel with a controlled lead addition was suggested by Ryerson metallurgists.

New Rycut 50 was a success from the start! Now, after two years, Harry Peterson, Logan plant superintendent, reports: "New Rycut 50 has saved us a consistent 25% of our former costs in the production of lathe spindles. Rycut's uniform machining and hardening properties have reduced scrapped parts to a minimum and the steel has proved satisfactory in every way."

This is just one of many case histories in our files on the steels in the Rycut series—New Rycut 50, Rycut 40 and Rycut 20. Actual performance records show machinability increased as much as 50% . . . tool life lengthened as much as 300% when a Rycut steel is used in place of a standard alloy of comparable mechanical properties.

To get further information on these great new cost-cutting steels or for quick shipment of any steel requirement, call or write your nearby Ryerson plant.

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE • CINCINNATI CLEVELAND • DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

how to produce

MORE IDEAS

Engineering is by definition a creative profession. Yet many engineers are handicapped by a paucity of ideas. In capsule form, here are some sure-fire ways of stepping up creative power and developing originality.

By James A. Houle

Field Service Engineer
Adhesives and Coatings Div.
Minnesota Mining & Mfg. Co.
Detroit, Mich.

Many new developments are available to be seized upon by the imaginative tool engineer and converted into ideas for improvements in manufacturing.

To GENERATE IDEAS for new and practical ways to solve problems it is important to know how to use the power of imagination. Since man's beginning, imagination has played a decisive role in advancing human progress.

Engineers today have a foundation on which to generate new and profitable ideas. Electronics, nuclear energy, automation and new production philosophies are some of today's knowledge that can be used to fashion improvements in manufacturing facilities. Full utilization of these and other developments in manufacturing requires creative thinking.

To fully utilize creative power to generate ideas, a simple understanding of how the mind operates is important. For the purpose at hand, the mind can be divided into three parts: "the loader, the thinker-upper and the judge."

How the Mind Works

The loader part of the mind collects the information the senses bring in. It is like a personal accounting machine, recording on mental punch

Three functions of the mind are important for generation of ideas: the loader, the judge, the thinker-upper.

cards the size and shape of objects and what a person sees and hears, sorting these cards into the appropriate slots. In other words, the loader relates the information to what an individual already knows.

The manner in which information is stored, as well as the amount, is important. For example, suppose that for the first time, two engineers see a new machine that automatically transfers steering columns through various stations and performs machining operations on the part at each station. The first engineer might simply store the experience with the mental note, "Here is a transfer machine that drills holes in a tube."

The second engineer, with adequate background information and a tendency to store cross-referenced experience, might note mentally, "Here is a five-station in-line transfer machine that produces 500 completely drilled automotive steering columns per hour. The machine loads and unloads parts automatically and drills, spotfaces, reams and deburrs holes. It has an air-powered transfer mechanism and is electrically controlled."

Irrespective of the nature of a production problem, the second individual who has a store of knowledge consisting of a group of related ideas is much more likely to form the mental associations that will lead to a solution.

The second important part of the mind is the judge. This part analyzes, compares and makes decisions. When generating ideas, however, the judge must be kept in his chambers until the problem has been specified, all the facts gathered and the imagination searched for alternatives. Then the judge is called in to evaluate the idea.

To take advantage of an idea it is necessary to take a positive approach. There will be many people who will say it won't work, or the boss won't like it, or it's foolish. Even though the idea may be excellent, the new fields that a new idea opens up will be visualized by only a few.

The thinker-upper part of the mind is the "idea-generator" and works on material brought in from the memory storehouse plus additional facts that are brought out as the problem is attacked.

The thinker-upper takes these facts and fits them together in one sequence after another. Out of these combinations are fashioned new ideas. Some of these ideas go well beyond what was previously stored in the mental card file.

How To Attack Problems Imaginatively

Before a problem can be solved, it must be analyzed and stated in its simplest terms. When generating ideas, every possible solution should be tried. Trying everything, however, does not mean shooting wild without a plan. On the contrary,

Hobbies and reading are pleasant methods for boosting an engineer's creative potential.

creative thinking is imagination with a purpose. It involves keeping the mind open and receptive to new ideas, or modifying the targets as new facts are learned.

Questions are great unlockers of ideas. "What if" and "What else" are two of the most important questions in any repertoire. Problems should be attacked with a persistent barrage of questions. The answers created are the alternatives for possible solutions.

A set of guide questions will help to suggest and seek out ways to solve problems:

1. What else can it be made of . . . Can it be modified? Where else can this be done? Could the package be used for something afterwards?
2. What if this item were larger . . . higher . . . longer . . . wider . . . thicker? How about extra value? Can this be increased? What if the item were enlarged?
3. What about making it more compact . . . Suppose this were left out. Can it be made smaller . . . shorter . . . thinner . . . lower? What if it were made lighter or faster? Does it need all these features?
4. What if this were turned upside down . . . inside out . . . reversed? Can cause and effect be reversed? Is one possibly the other? What if the order were changed . . . What happens if it were turned around?
5. What can be substituted? What is similar to this but costs less? Can a vendor supply this for less? What other materials would do this job? What other layout might be better? What other power would work better? Can a standard product be found which will be usable?
6. What other method or shape would improve its operation or efficiency? What does this part do? How would it be designed if it were to be built elsewhere? Should it be put on the other end or in the middle? Would this be better symmetrical or asymmetrical? Should it slide instead of rotate? How could this be changed for quicker assembly? How could this be made easier to use? Can it be done piecemeal? How much of this is the result of custom, tradition or opinions? Why does it have this shape? Can motion be added to it or is it better standing still? Can it be made safer? In what form could it be—liquid, powder, paste or solid, rod, tube, triangle, cube or sphere?
7. What do others outside this field do in a case like this? Has a search been made of the patent literature or trade journals? Is it already being supplied by another source?

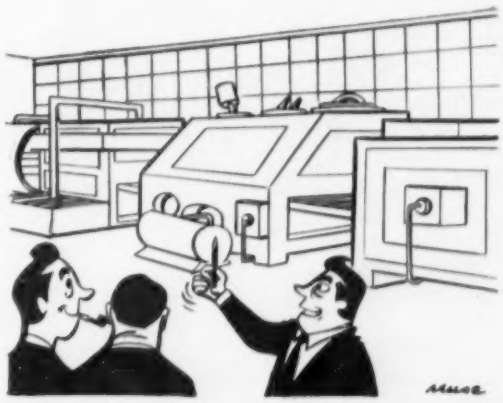
To best stimulate the creative process, a place of privacy or at least one place where the mind is relieved of the pressure and excitement of routine problems is important.

Many times an inspirational thought on how to solve an issue will flash through the mind. This sudden flash is called "illumination," another way of saying that when the conscious mind cannot jog loose a satisfactory solution, the subconscious mind may plug in cross references, splice past experiences with the present and pull the right switch to light up a possible solution to the problem.

It can happen in a shower, while shaving, driving to work or reading the comics. To make idea-generating a habit, a system should be developed to help stimulate the imagination. Following are a few tips:

● Set certain times for thinking up ideas. Early morning is usually the best time because the mind has had a night's rest and is fresh. A pad and pencil are big helps. If the spark of an idea is not written down when it is born, it may be lost forever.

● Keep a notebook or box where ideas can be left to incubate or be available for discussions when the right opportunity comes. Some ideas have no immediate value but when returned to later they can inspire other ideas which are improvements on an old one or pertinent to another needing immediate attention. Set a quota for ideas. Start with one a day. Then take on larger quotas as creative power develops.



Touring others' plants, including those in different industries, can be a real stimulant to new ideas.

● Set deadlines. Unless this is done, a person may wait forever for that spark of genius. Virtually everybody works better under pressure. The desire to achieve an end within the deadline can be an excellent prod to the imagination. While too much pressure may squelch mental resourcefulness, establishing goals can be a challenge to stimulate increased brain power.

● Ask questions. Will a change in operation se-

quence improve the part? Can an operation be simplified or made safer? Can scrap be saved or used? Can office forms or procedures be simplified? Can the quality of a product be improved?

● Look around at the job, the plant, the machinery used, what is produced and how it is made, and see if they can be improved.

● Can a less-expensive material be substituted satisfactorily for the material now in use? Can this material be trimmed or cut differently for greater economy or efficiency? Can a special tool be used to combine one operation with another? Can another machine do it faster, easier or better?

Exercises Boost Creative Power

An engineer might complain that his job is limited or his future looks bare. Yet in his own department there can be obvious needs for new ideas or changes in product quality, production rates, waste reduction, etc. There are some specific idea-starters that can promote creative thinking and, in turn, lead to greater personal profit and success.

An engineer without ideas is a person without a future.

To boost creative powers, the mind must be exercised. For instance, it is a demonstrable fact that practicing mental arithmetic 20 minutes a day for 20 days will double a person's capacity to calculate. Similarly, letting the imagination roam and be habitually inquisitive is helpful. Curiosity is important to creativity, but effort is its essence.

Reading is certain to boost creative power. Creativity not only depends on mental flexibility but also upon experience. Reading will open up new horizons. Ideas and information can be quickly obtained through technical papers and in technical magazine articles as well as from books.

Biographies will tell what great men have done. Information gathered from this type of reading could be put to use for greater success. Reading many types of publications and magazines can supply raw material to the mind's loader mechanism. Of course, it is important to be selective in choosing reading material as well as to think while reading. In this way, more ideas will enter the mind. Many times, ideas are sparked by passages that are not even related to the problem at hand.

Puzzles are a good promoter of ideas. The mental gymnastics required in solving puzzles is a challenge to the ingenuity. It gives good practice in trying one combination or idea after another, to fit the framework of a problem.

Hobbies also are good exercises if they put the imagination to work. Painting and drawing are creative in themselves. Pencil lines or brush marks are fuel for creative power. All handicrafts rate high. Making something better satisfies the soul and stimulates the mind.

Conversation and public speaking can be a boon to imagination and original thinking. Debating or active participation in meetings will step up creative agility. Mental footwork needed to interpret another's ideas, as well as the challenges offered in formulating a response, are stimulating.

Writing is an exercise in idea selection. It tones up the mental muscles. Writing technical articles for trade publications or papers for technical societies takes practical advantage of creative exercise.

Travel is another source of information for the mental storehouse. Learning how others have solved problems is possible by touring their plants and factories. Being away from the job gives an opportunity to meditate, leaving the mind open to any stimulus. Notes should be kept so that later they can be referred to for new ideas obtained during these trips.

Summary

To best generate ideas, make full use of two important questions: (1) What if it is changed to . . .? (2) What else could be done with it . . .? When an idea is born, it should be written or sketched. More than one solution should be sought for a problem. As many different alternatives as possible should be generated. Three or four alternatives can inspire even more ideas—and in many cases better ones, too.

When an idea is created that sounds uncommon and maybe impractical, it should be examined for benefits and reasons why it might work. It is always easy to find things wrong with any new idea. Creative imagination is needed to find the good points in an idea and apply them to specific manufacturing problems.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

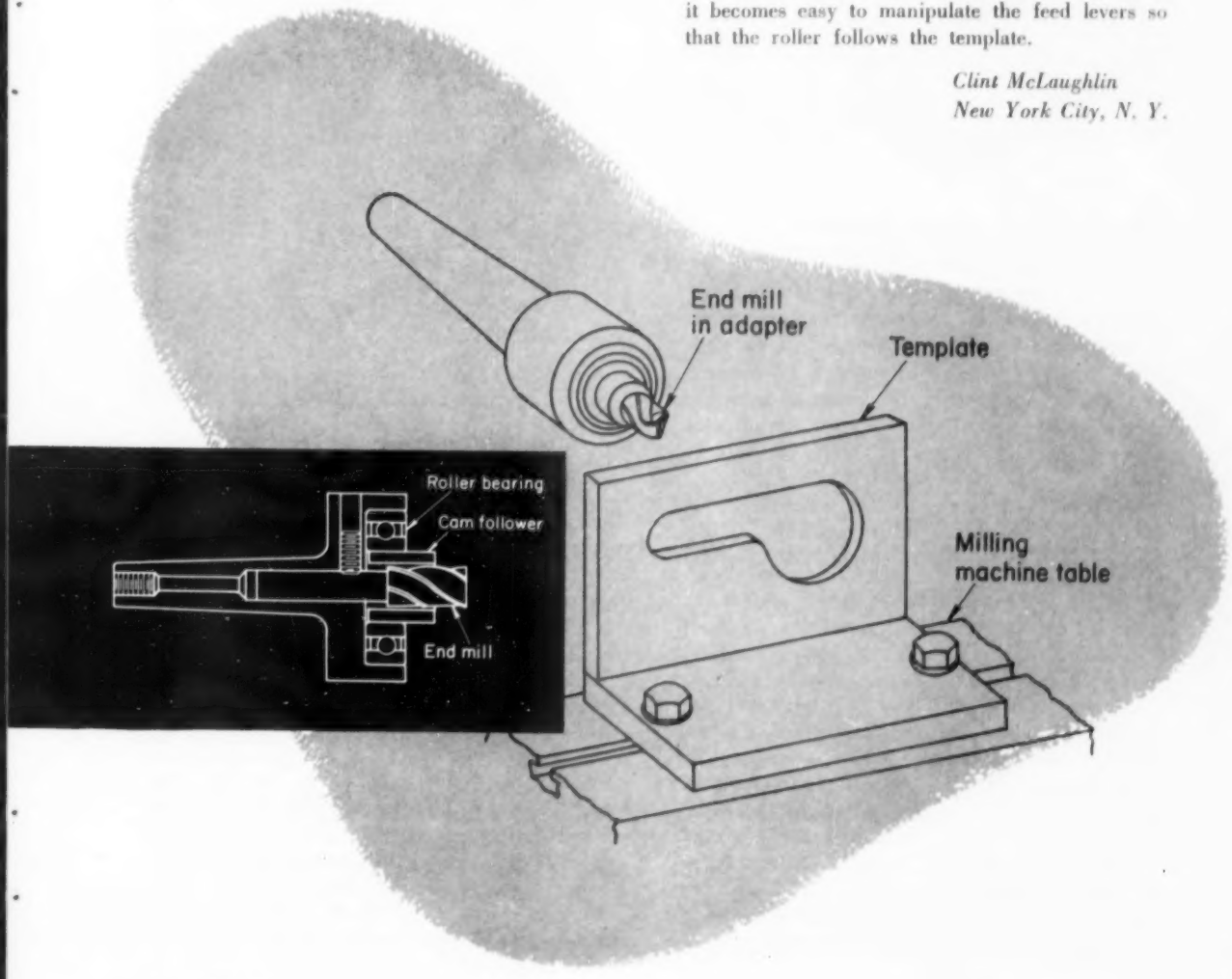
Milling Template

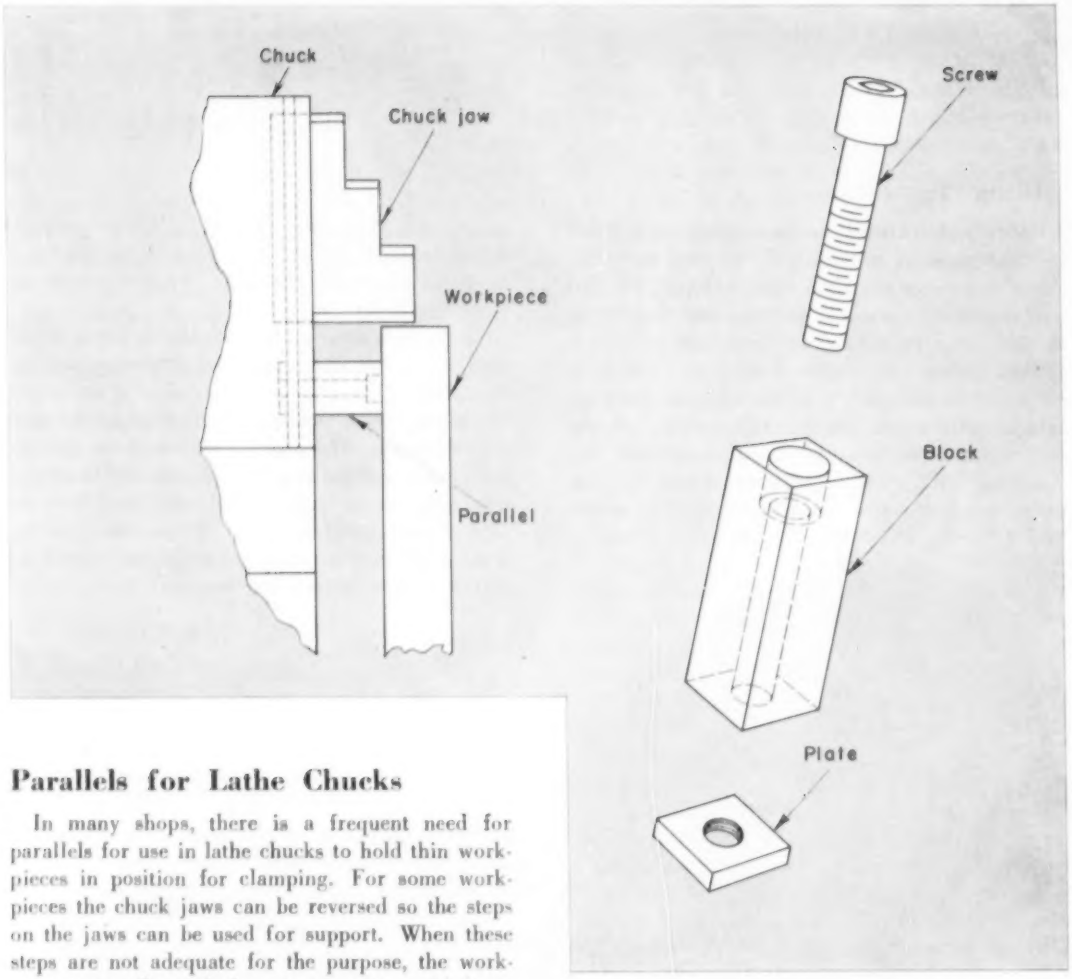
Recently a production department was faced with the problem of milling the edge of an irregularly shaped opening in a small casting. The fixture illustrated was made up to permit this job to be performed in a hand milling machine. Components of the fixture are a base plate fitted with the necessary clamps to hold the workpiece, and an upright plate which has a cut-out section of the same shape as the opening in the workpiece.

Cutting is done with an end mill mounted in the special adapter shown in the drawing. The cutter is locked in place so it will rotate with the adapter. A ball bearing, pressed into the adapter, carries a hardened cam follower roller. This roller does not touch the cutter.

The cut-out area in the template is made larger than the desired opening by the difference between the radius of the cutter and the radius of the roller. In use, the roller runs along the edge of the template opening. The opening is milled to size by feeding the machine table horizontally and vertically with hand levers, causing the roller to follow the edge of the template opening. With a little practice it becomes easy to manipulate the feed levers so that the roller follows the template.

Clint McLaughlin
New York City, N. Y.





Parallels for Lathe Chucks

In many shops, there is a frequent need for parallels for use in lathe chucks to hold thin workpieces in position for clamping. For some workpieces the chuck jaws can be reversed so the steps on the jaws can be used for support. When these steps are not adequate for the purpose, the workpiece is usually packed up into position with loose blocks which must be removed before the lathe is operated.

The parallels illustrated, which are made up in sets of three, are secured to the chuck by a screw threaded into a plate which hooks under the two keys in the slot where the chuck jaw rides. This arrangement is easy to set up and the parallels can be left in position for repetitive work.

Henry Koslow
Bronx, N. Y.

Machining Openings in Die Blocks

Tool and die shops are frequently faced with the problem of machining rectangular openings in die blocks. These openings are usually made with radii in the corners. The conventional procedure is to saw most of the stock out and then finish the opening by filing. With this method it is difficult to get the sides straight and square with each other and filing is a tedious process.

Milling is a more desirable method of finishing the opening. The milling method illustrated is intended for machining openings where the radii in the corners are too small to be machined with a standard end mill.

The tool used is a standard die sinker's cutter with a 7-deg taper. Radius of the small end of the cutter is the same as the radius to be milled in the corners of the opening; thus, for a $\frac{3}{32}$-inch corner radius a $\frac{3}{16}$-inch diam cutter is used.

The cutter is set up in a vertical milling machine and the machine head is titled 7 deg to the side and

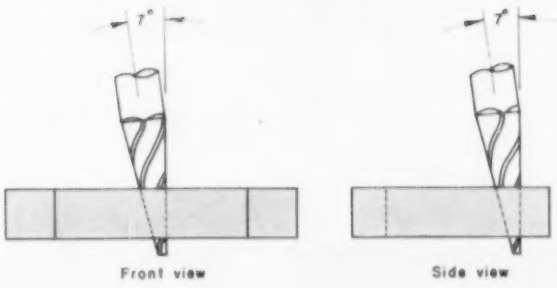
Gadgets

7 deg to the front, Sketch 1. A cut is made along the rough sawed opening as shown in Sketch 2 until the cutter enters the corner and cuts into the side wall. At this point the machine table is lowered to remove cutter from the opening. This operation brings the radius of the corner to the same size as the radius of the cutter. With the radius completed, the table is raised and fed in for machining of the end wall.

When about half of the end wall has been machined, the cutter is tilted 14 deg, that is, instead of being tilted 7 deg to the front it is tilted 7 deg to the back. With the head in this position the end wall can be completed and the corner and half the front wall can be cut. The remainder of the opening is machined in the same way.

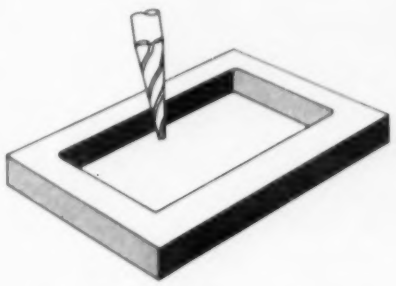
The method described saves a great deal of time and does an excellent job. Tapered cutters are available in a variety of sizes. When no cutter of a desired size is available, one can be made by grinding off the end of a smaller cutter until it has the correct diameter.

Perry Conway
Philadelphia, Pa.



Position of milling cutter

Sketch 1



Cutter in position for milling die opening

Sketch 2

Overcoming Indicator Point Wear

When parts fail to meet dimensional specifications, there is a possibility that the gage itself may be at fault. Wear on indicator points, for instance, can easily cause inaccurate readings. This was forcibly brought out in one case in a production shop where a 2.001-1.999-inch ID hole was being reamed in a stainless steel rotor wheel. The machine operator used an indicator bore gage set with a 2.000-inch ring gage to check the hole. The ID of a reamed hole was measured as 2.001 inches by the operator. When the rotor wheel was sent from the machining area to the final inspection area, identical methods of measuring were used which showed that the hole was 0.0003 inch oversize. Consequently, the part was scrapped.

A check showed that the indicating points of the machine operator's gage were worn, causing a false reading. The inspector's gage was in good condition. Wear on the machine operator's gage had occurred during a previous production run when he was measuring a group of rotor wheels having a 2.500 ID. As a result of excessive use of the indicator gage on the same size parts, a 1.250 radius became worn on the indicator points. This made it impossible to get an accurate reading when gaging the 2.000-ID holes.

Subsequently, carbide-tipped indicator points were used on the same gage and no difficulties due to wear of indicator points were experienced, even when the same gage was used for measuring several different ID's.

Raymond O. Andrews
East Detroit, Michigan

axiomatic system

simplifies assembly tooling

R. A. Wagner*

Chief Tool Engineer
Crosley Div.,
Aveo Manufacturing Corp.
Nashville 1, Tenn.

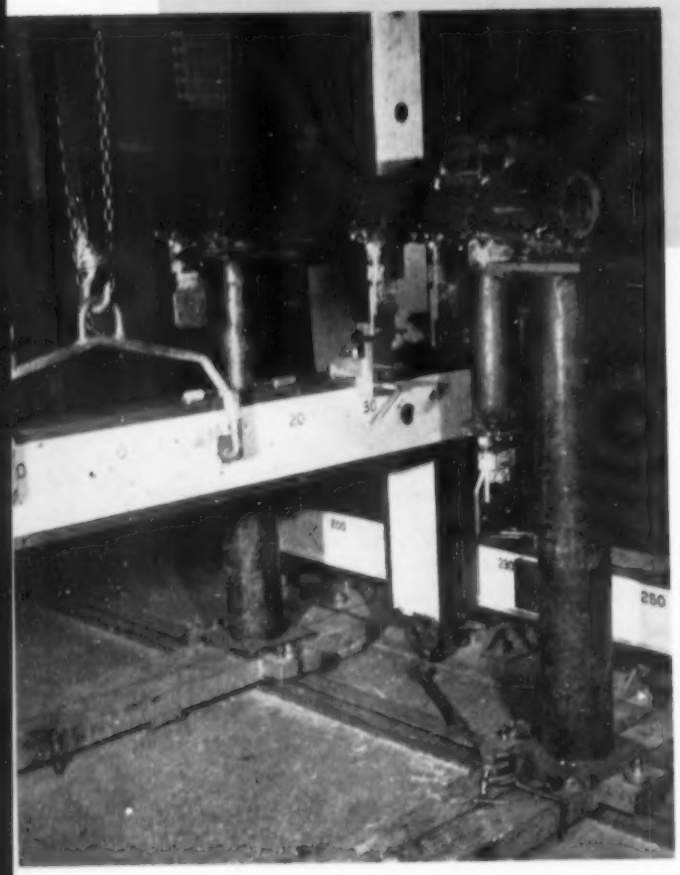


Fig. 1. Position settings are established in three planes in making masters, such as this elevator fixture, in a tooling dock. Once locating points are established, the locator assembly is fixed by pouring low melting alloy around the support detail. For added strength, dowels are fastened through pot and support.

Because of the type of parts and precision demanded for interchangeability, airframe production involves many problems virtually unknown in other industries. A method of tooling that promises a way around these difficulties is well worth careful consideration. The method of tooling discussed in this article may provide the answers to these problems.

PRODUCT ENGINEERING drawings, engineering loft layouts and engineering specifications are basic information for tooling and production of assembled products. This information defines the product with dimensional, mechanical and surface requirements including interchangeability and quality.

Planning for manufacture often requires some modification of original engineering information to determine the best manufacturing plan. So that such problems may be solved, both engineering designers and tool engineers must cooperate and coordinate their efforts. They should base their studies for the first prototype model on the production quantities involved and plan in such a manner that tooling built for a prototype model is accurate and can be used later in a production line.

One of the results of such a study is a breakdown of the major components of an airplane into units suitable for the production quantities established. In preparing this breakdown special consideration must be given by both design and manufacturing engineers to cleavage or dismemberment points. This is important in order that these points meet

* Senior member ASTE Nashville chapter.

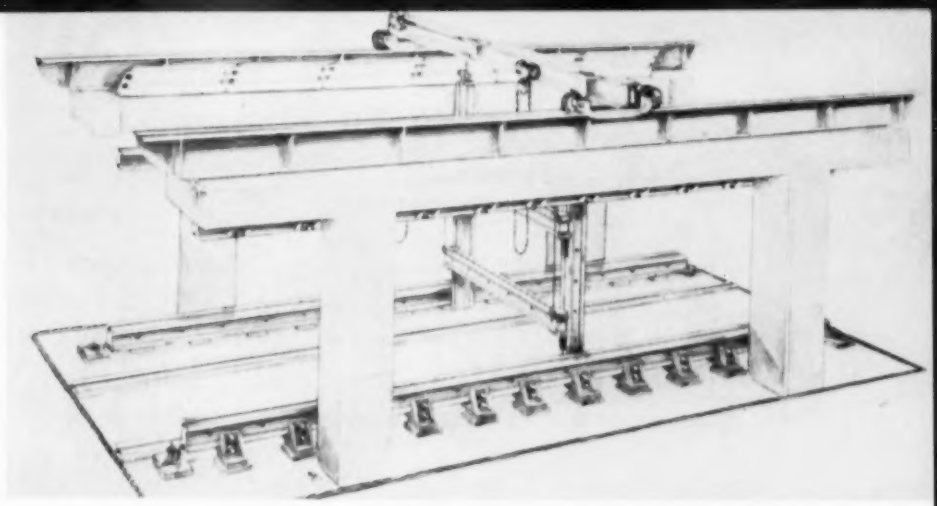


Fig. 2. Tooling dock affords a three-dimensional locating means. This permits rapid and positive locating of any point in space with respect to the aircraft reference lines.

stress requirements. Engineers must also give much consideration to interchangeability, areas requiring master tooling, engineering loft requirements and the method of loft reproduction which will be used for tool manufacture.

Complicating such problems is the fact that one manufacturer may not produce the entire product. While he may manufacture only certain components, they must be produced with due concern for the end product. Regardless of where parts are made, they must fit and assemblies must mate; each must be held strictly to engineering specifications.

Crux of problems of tooling for production of interchangeable components in the airframe industry is how to secure necessary accuracy in masters, *Fig.* 1, and transfer gages. True interchangeability can usually be obtained by use of one correct master. Conversely, the presence of two or more masters not absolutely identical has caused much trouble.

There are, however, disadvantages in the use of one master as a control medium for construction of fixtures, or checking interchangeable components, especially where several plants are producing the same parts.

Avco research and development have worked out a method to eliminate inaccuracies in tools, such as encountered in repair of damages or in making engineering changes. Further, by use of this system, termed "Axiomatic," it is possible to duplicate any number of masters to exact dimensions and guarantee them to be identical. It has been this company's experience that no matter how carefully duplicate masters have been constructed by conventional methods, they are not identical; if a damaged master is repaired it may not be identical with the original, so the cause for skepticism of these tools is well founded.

Basic element in the Axiomatic system is a master tooling dock, *Fig.* 2. This is a three-dimensional positioner for mechanically locating a point or plane in relation to the theoretical reference lines used in aircraft design. The dock consists of the following components: a steel reinforced concrete structure placed on a reinforced concrete island, which is isolated from the factory floor; four aligned straightedges, called longitudinals; transverse and vertical straightedges on tracks; and lifting and crane mechanisms.

The longitudinals are anchored to the island and superstructures by "knee-fittings." Adjustment bolts are provided on each knee-fitting. Misalignment between the straightedge and knee-fitting is compensated for by a series of spherical washers on each bolt. Each of the longitudinal straightedges is comprised of three individual units ten feet in length. Working surfaces are matched and held by ground splice plates.

The longitudinals, as well as all other straightedges in the dock, are equipped with 0.500 inch diameter bushed holes along the entire working surface in 10.000-inch increments. These holes make it possible to divide the dock into reference grid lines, corresponding to water lines, buttock lines and station lines used in the product design. These holes are used for positioning operations in the dock. Each straightedge is also equipped with T-slots and a number of movable T-nuts are placed throughout the dock for locking various types of fittings in position.

Measurement of height is determined from the vertical straightedges. These are tracked in fore and aft directions by the crane mechanism and raised or lowered for alignment to the longitudinals by the lifting mechanism. The verticals are located at a desired position by a station fitting. These fittings have been locked into position before placement of the verticals. A pair of bolts inserted in the T-nuts in the longitudinal slot serves for this purpose.

Location is accomplished by fastening a microbar between two of the 0.500 inch diameter holes on the longitudinals. This device is so constructed that any increment of measurement down to 0.001 inch may be attained between any two holes with the help of a micrometer caliper or other precise instrument.

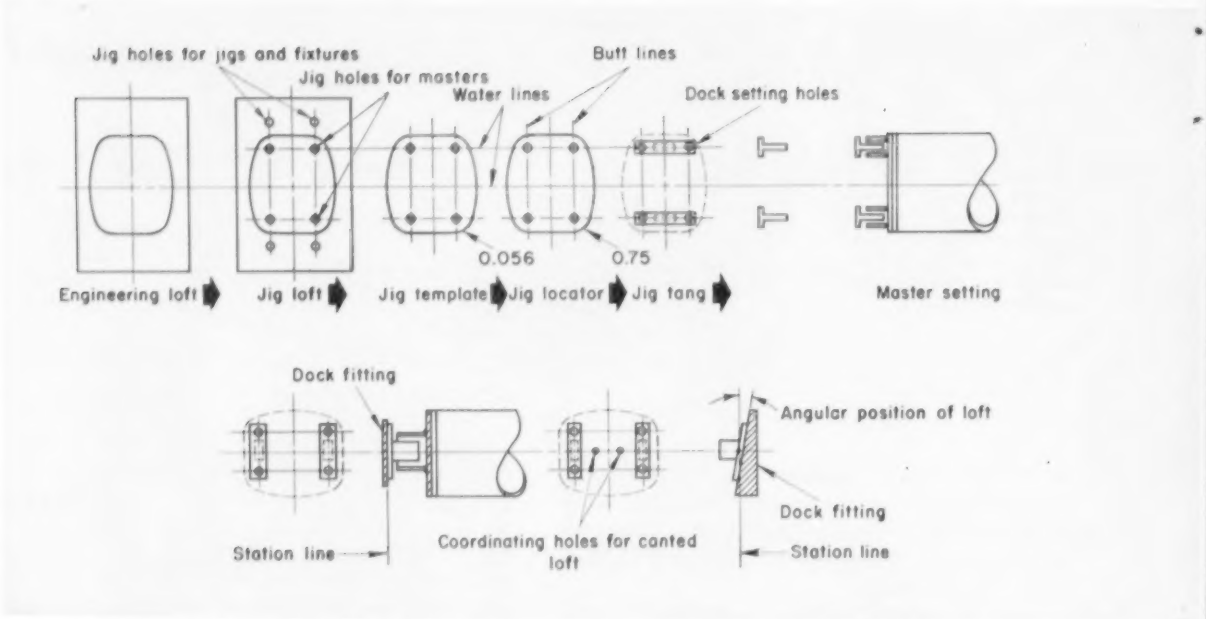


Fig. 3. Steps in tooling a bulkhead assembly in normal and canted positions.

By placing a station fitting at the upper and lower extremities of each vertical, and at an identical fore and aft station on the longitudinals, a cross-sectional plane can be established. To complete locating a point in space, it is only necessary to have an additional means for locating on the cross-sectional plane. This is accomplished by additional straightedges, namely, the transverses. These are supported on the verticals and are brought into location by the same principle used in locating the verticals to the longitudinals. When a cross section is completed, adapter fittings are fitted to and indexed on the transverse straightedges to hold and position the various types of jig details.

By having this tangible, stable and positive means of projecting points into space it is possible to check back to original reference points at any time. This is the prime advantage of the master tooling dock in fabricating precision tooling.

Use of the master tooling dock eliminates conventional transits for alignment and scales for physical measurement between station lines, water lines and butt lines in making jigs and fixtures. This has always been a source of error in building conventional tooling and prevents coordination in three planes. Where conventional tooling may fail in coordinating, Axiomatic tooling will give successful coordination.

This system of tooling is based on a number of general principles and procedures developed over a period of years, some of which have previously been mentioned. For instance, consideration must be given at the beginning of a project to both prototype and production tooling. Critical points of assembly must be carefully considered by manufacturing engineers in order to create adequate tooling to insure accurate interchangeability. Preparation of flow charts enables the tool planner and other interested manufacturing people to see an entire assembly in disassembled form.

Glass cloth layouts are prepared for master loft and template duplication. Photo reproduction of the engineering loft is utilized for rapid and accurate template duplication. To insure proper coordination, a jig loft is used to transpose contours from the master loft to the jig tooling. Transfer and master gages, jigs and fixtures are designed in such a manner that they can be set in three planes by a fixed mechanical method; namely, the tooling dock, instead of using portable or hand instruments, plumb bobs or transits. Finally, matrix pots are used to fix detail locators to the rough structure and details are held in space mechanically, *Fig.* 1, and frozen into the pots by pouring heated Cerromatrix. Step by step inspection of completed tooling is accomplished by optics and lines of sight, using built-in telescope and target fittings.

While no one of these steps in itself is completely new, the over-all approach is an advance over previous piecemeal methods. For example, instead of working from details outward to assemblies, the final assembly fixture is established first. By using the master tooling dock to coordinate the detail, fixture and tools of the assembly, correct coordination is assured and problems of accumulating tolerances are eliminated. Similarly, when a question

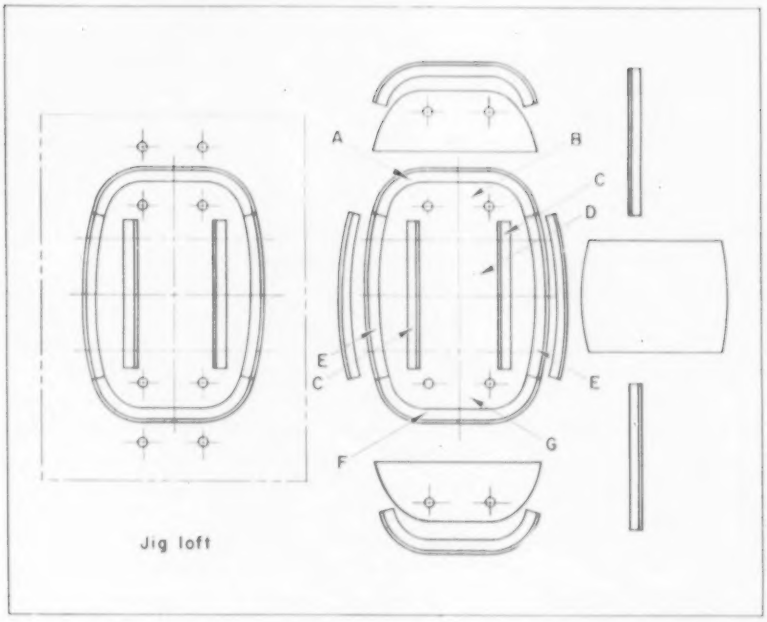
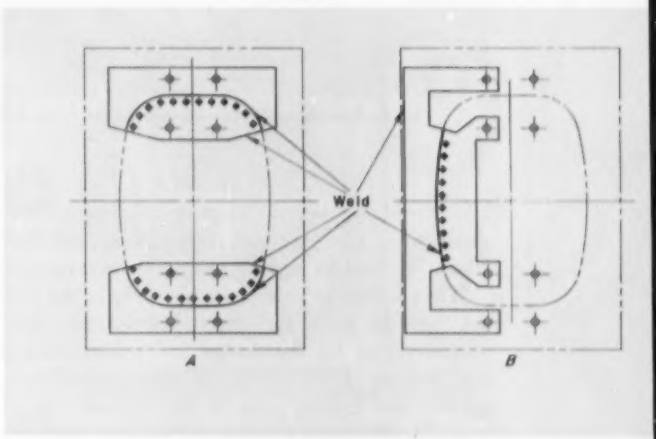


Fig. 4. (left) Detail parts of a bulkhead assembly in relation to its jig loft. Each letter represents a detail part.

Fig. 5. (below) View A shows side contour and attach hole pattern; view B gives contours and hole patterns for top and bottom portions of subassembly.



arises over the fit of detail parts, it can be taken for granted that it is the detail that must be corrected. This automatically cuts the chances for trouble in two.

Because use of the tooling dock speeds fabrication of jigs and fixtures, many subassembly fixtures can be set in the dock. This gives assurance that they too will fit accurately. Further, it is possible in high production programs to break down large assemblies to convenient small subassemblies which may be impossible with conventional methods. Because this system assures exact duplicate fixtures, it is possible to quickly accelerate into a high-production program with many fixtures.

An example of this system of tooling is illustrated in *Fig.* 3. It shows two bulkheads, one parallel to a station and one canted. These two stations can be considered as establishing breaking or coordinating points of an airplane component. The two bulkheads indicate a configuration of parts or subassemblies that attach to a structure at each station. To insure perfect alignment, the water and butt lines on the loft must be in proper relationship with the station lines. A method of fixing them in position must be established. Therefore transposition of the engineering loft is made photographically to the jig loft by addition of a hole pattern that has been determined as suitable for coordination and for the manufacture of master, transfer gages, jigs and fixtures.

The hole pattern as shown was established for the manufacture of templates, jig locators, jig tangs and dock-setting fittings. The term jig is used for both masters and manufacturing tools. The holes noted inside the bulkheads are for the manufacture of master or transfer gages, while the outer holes are for the manufacture of jigs and fixtures.

When in the process of study for the design of the tools, the tool design engineers establish a hole pattern in suitable locations for alignment with a number of lofted subassemblies in order to hold the corresponding water and butt lines in relation with one another. In establishing the hole patterns, consideration is also given to the locator and tang details of the master tools or jigs and fixtures. They are set not only to water and butt lines, but to station lines as well, thus establishing coordination of all tools in three planes.

The original glass cloth masters, established by engineering loft, are then changed by adding the necessary jig loft holes, transposing each into jig

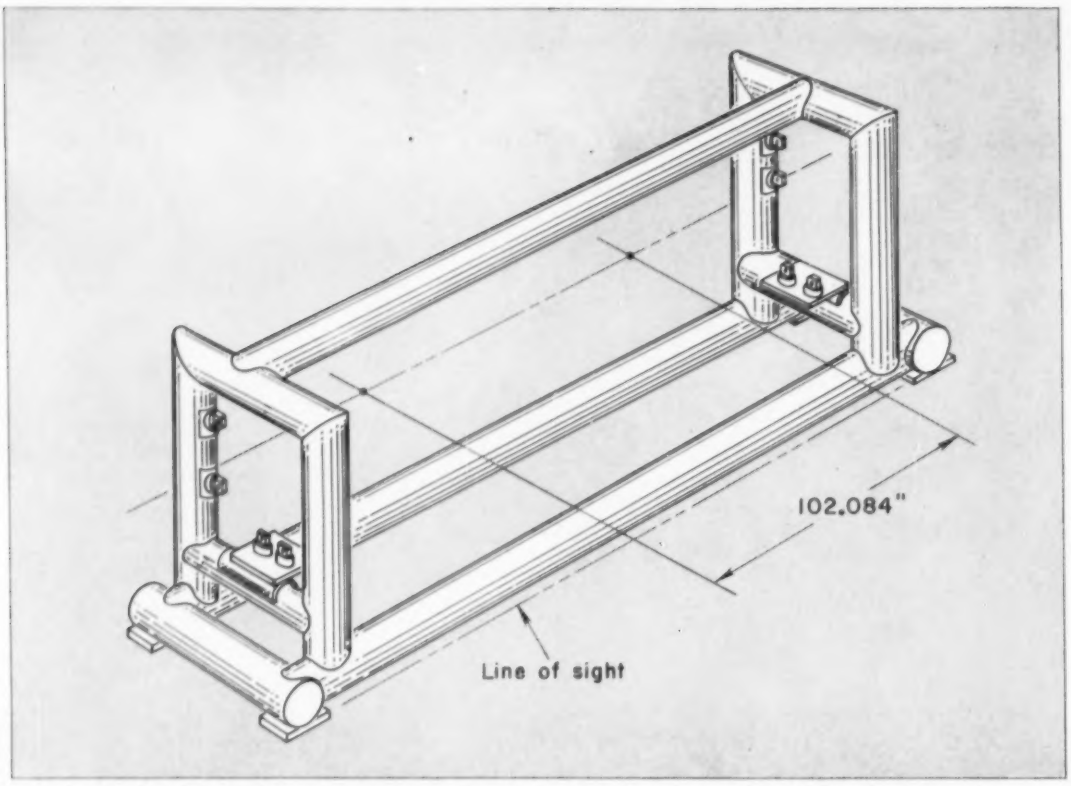


Fig. 6. Rough assembly fixture prior to attachment of the locating points with pot details in place.

loft. Metal loft boards, made by photographic reproduction, are cut into tooling templates from which jig locators and jig tangs are manufactured.

When lofting is located on an angle in the product, locating holes are established for calculation purposes and for the design and manufacture of dock fittings. Dock fittings are manufactured to set jig or mater tooling parts in three planes. In general, jig loft establishes two planes and the tooling dock, the third plane or the stations to which coordination must be maintained.

Production jigs and fixtures can either be set from a master or transfer gage or set independently in a mechanical device such as the master tooling dock. In fact, a jig or fixture can be made and set from a master or transfer gage or, on the contrary, a master or transfer gage can be set fom a jig or fixture by reversing the procedure.

The jig loft of a bulkhead, *Fig.* 4, includes the outline of detail parts that go into a minor subassembly. This figure shows the method of using jig loft for coordination. The bulkhead consists of parts A, B, C, D, E, F and G. Contours of the subassembly and spacing in relation with other bulkheads that go into the next assembly are critical. To properly coordinate all components of the major assembly, each subassembly must be correct and each part that goes into the subassembly must also be correct.

From the glass cloth masters of jig loft any required number of duplicate metal copies can be reproduced by photographic processes. These copies can be cut up into jig or tooling templates for detail parts. From these, production parts or tools can be made or set.

A subassembly for a bulkhead similar to the one described can be fabricated either by predrilling or piercing holes in each individual production part or by assembling all parts involved, less attaching holes, in a jig for drilling through the mating parts. The first method would be preferred for high production, while the second would be more economical for low-production quantities. In either case, proper coordination can be maintained by use of jig loft.

By use of any two of the eight jig loft holes shown, points can be established in relation to any contour, pattern of attaching holes for subassemblies, complete componets and assembly of all components into a final assembly. From these same holes, master tooling, jigs and fixtures and all manufacturing and quality control tools can be built, set and coordinated.

The method of cutting jig loft boards into tem-

plates for use in manufacturing detail tools is shown in *Fig.* 5. Some of the same templates can also be used for manufacturing major and minor jigs and fixtures. The same patterns of jig holes are used throughout and all templates coordinate to the same original jig loft holes or coordinate points.

Contours can be tied together and predrilled holes for detail production parts can be tooled by transferring the same hole pattern established on the jig loft. Typical side contours and attached hole patterns are shown on *Fig. 5A*, while *Fig. 5B* indicates the same for top and bottom portions of the bulkhead. Other templates can be coordinated in the same manner. Loft boards can be duplicated in whole or part, depending on the portion required to make the necessary templates; for instance, *Fig.* 5B requires only the upper and lower portions of a loft board. To conserve metal, only those portions required are reproduced. Two boards are required to make a male and female template.

If all production predrilled detail parts are developed to the jig loft in the manner described, they can be accurately assembled together with the aid of a holding fixture. This fixture would locate the parts from contour, using blocks coordinated to the templates or to attach holes transferred from the original jig loft layout and to the eight jig loft coordinating holes.

If production detail parts are predrilled, an assembly and drill jig will be necessary. This may be manufactured by attaching a jig loft board to the top face of the jig plate or table. Then, the next step is drilling and placing locating pins in the eight jig loft coordinating holes. From these and the templates nesting blocks for contours and drill plates can be made and accurately set. Up to this point coordination has been established in two planes, to water and butt lines. Any holes predrilled in the side flanges of the production parts can be coordinated and pinned to either the jig loft holes or other holes that were taken from the jig loft holes to a station line measurement from the face of the bulkhead.

The next step is to establish station line dimensions for spacing two bulkheads accurately. Suppose the station line dimension between a canted and noncanted bulkhead is 102.084 inches, then an assembly fixture would be required to make such a setting accurately.

A typical rough structure of an assembly fixture is shown in *Fig.* 6. This structure has mounted on it necessary pot details for setting and fixing in place with heated Cerro-matrix, jig tangs or locators. These are set in three planes by use of the master tooling dock. Station line or the 102.084-inch dimension can be established by setting the dock to 10 centers or 100 inches, then by indexing a microbar from hole 100 to hole 110. The microbar is then adjusted to a micrometer reading of 2.084 inches, giving the desired result. Necessary dock setting fittings are made to receive a canted bulkhead or part and compensation made in the station line settings for them.

An end view of the rough structure indicating the setting of water and butt lines to the jig loft holes is shown in *Fig.* 7. Tangs or jig details are pinned to the crossrail of the tooling dock in relation to the station line upon which it is to be set. The tang protrudes into the pots on the structure and, after inspection, heated Cerro-matrix is poured, bonding the tang into place according to dimension. Later, dowels are driven through the tang, Cerro-matrix and jig pot for greater rigidity.

Going back to the jig loft, the same pattern of jig loft holes is carried through templates and transferred to tools for detail parts, subassemblies and

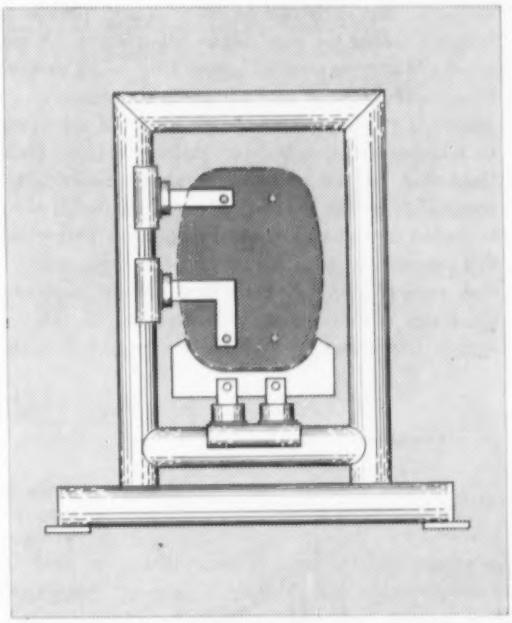


Fig. 7. End view of assembly fixture shown in *Fig.* 6, indicating use of jig loft for locating holes.

major assemblies to final assembly or mating fixtures. This system lends itself to complete coordination.

Since it is often necessary to mate component units manufactured and assembled at different sources, a method of establishing and maintaining coordination is an essential element of any tooling system. If the prime contractor has a single quality control master and furnishes it to several sources, each will have to take impressions from it for duplication purposes or to make quality control

tools for use in the individual facility. Although design of fixtures may be different, each facility must manufacture quality control tools so that holes and contours for the respective component units will coordinate and assemble with each other.

With the system described, transfer or master gages and major jigs and fixtures can be made from each other. An inspection fixture can be so designed to transfer and set the impression from a customer-furnished master exactly to dimension and contour.

By use of the outlined method of coordination, starting with jig loft and following through to the minor and major assembly fixtures, it has been found that tooling is built so accurately that only periodic inspection or cycle mastering is required for the major tooling which affects coordination and interchangeability.

Each transfer or master gage, each major or minor assembly fixture and each major checking fixture is equipped with fittings for optical instruments so that each can be checked individually to insure no changes have taken place since the last check. Master or transfer gages, after being checked by optical methods and adjusted, if necessary, are placed in the fixtures and cycle mastered according to schedules established by quality control. Final inspection of the product is accomplished after removal from the fixture. If required, the product is placed in a quality control inspection fixture for this purpose.

A typical case of production tooling problems illustrates advantages of coordination. In this instance, five assembly fixtures are supposed to be exactly alike and all detail tooling for parts which are to be assembled are already in existence. It was found that certain detail parts would not fit into each assembly without extensive hand fitting. A study of this problem revealed that the detail tools were made to loft and were correct but the five fixtures are apparently in error, no two being exactly alike.

The tooling department, from basic loft information, designed and built a transfer gage with a supporting dolly, *Fig.* 8, using the tooling dock method. All five fixtures were then reset to the transfer gage. This operation immediately disclosed that the detail parts as manufactured will assemble in any of the fixtures without fitting or trimming. The support dolly is designed so that the weight of the gage does not rest on the jig while resetting.

Summarizing, this discussion has indicated how the use of this system for coordination of tooling can simplify problems of aircraft production. Tools built by this system are simpler to construct and assemble. Better alignment and coordination are maintained and tolerences are held closer than they can be by customary methods. The cost is much less and the time span to build them is shorter. In addition, damaged masters can be repaired and restored to original dimensional settings; exact duplicates can be made and coordination can be maintained throughout. Jigs can be made from masters and masters from jigs in a shorter period of time and at less cost. This also reflects in lower cost of the end product.

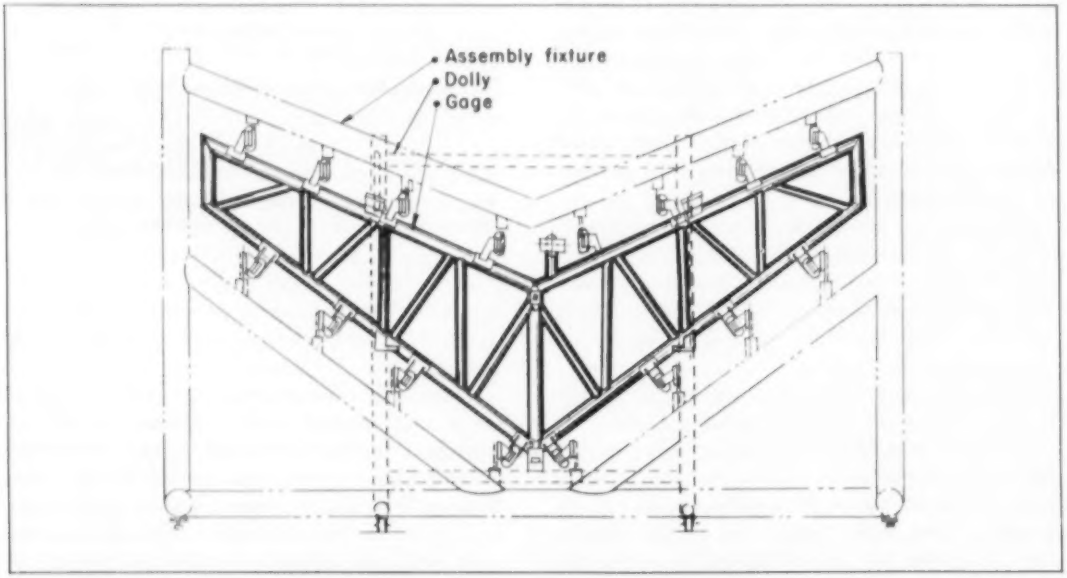


Fig. 8. Transfer gage of horizontal stabilizer in position in assembly fixture, which is shown in phantom.

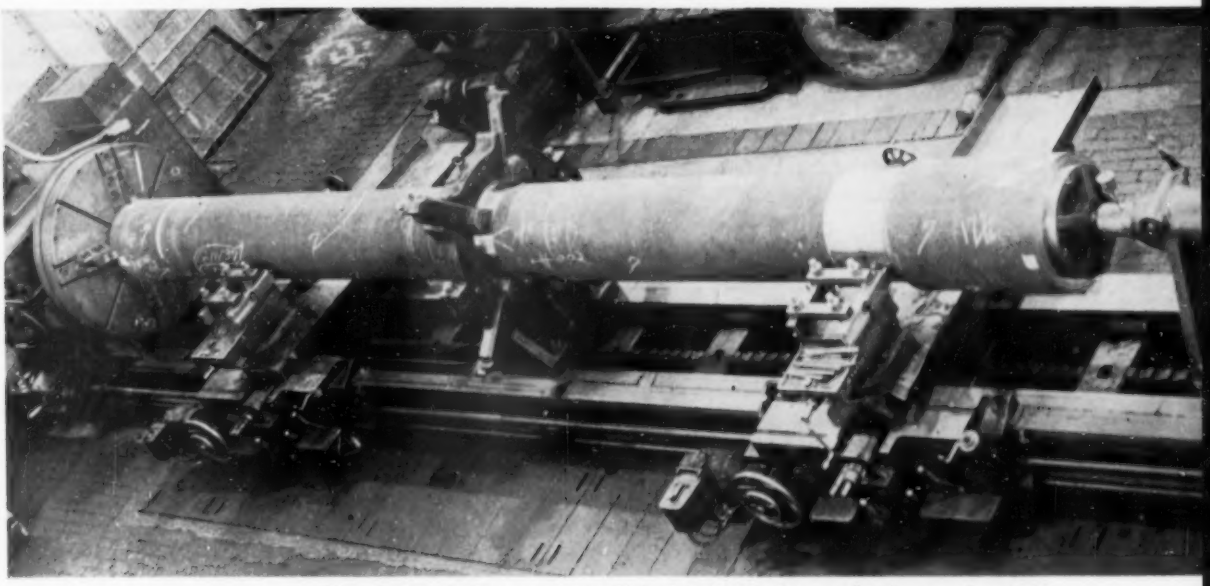


Fig. 1. Gun jacket set up on 60-inch lathe during production turning tests to compare results of brazed and insert type cutting tools.

mechanically clamped vs. brazed carbides

...a production cost study

By **Leo T. Parker** *
Project Leader
and
Millard T. Douglas
Technical Writer
Manufacturing Methods Unit
Watervliet Arsenal
Watervliet, N. Y.

Arsenal tool-evaluation tests are especially interesting because they comprise directly comparable production tests and give precise cost figures. Mechanically held carbides saved time and money in the turning tests described in this article.

PRIOR TO EVALUATION of solid carbide inserts at Watervliet Arsenal, brazed carbide-tipped cutting tools were exclusively used for both rough and finish turning of ordnance items. Such tools were practical in that production schedules were being met, but maintenance costs were high. Versatility of the tools was limited and, because only one side of each tip was used, large quantities of tools were required, creating handling and storage problems. Following successful tests on solid inserts, a program for tool modernization and standardization was begun.

Some of the specific difficulties resulting from the use of brazed carbide tips are heat-induced strains in the carbide which result in cracking or breaking during grinding or cutting. During heavy cuts, a

* Senior member ASTE Hendrick Hudson chapter.

braze frequently would soften and the tip could shift. This caused excessive breakage. Individual brazed tools were limited in the number and type of operations they could perform. Grinding was expensive because both carbide and shank materials had to be ground, and shank life was limited by the number of times the shank could be ground.

Early toolholders, in which a carbide insert was mechanically clamped, could not be used in government facilities because policy dictated that several sources of supply had to be available. These inserts and toolholders were not interchangeable. Watervliet engineers initiated a test program as soon as the sizes and shapes of inserts were standardized. Toolholders differed only in the manner of clamping the insert and could be used with inserts of any manufacturer.

One of the first tests was a production comparison between brazed and clamped tools turning 280-mm-gun jackets and tubes, *Figs.* 1 and 2. Band, pocket and yoke-clamp types of toolholders were evaluated during these tests, with the band type holder proving most practical for this operation.

The alloy steel gun parts had hardnesses of 320 to 342 Bhn. All cuts were taken dry and the same grade of carbide was used for inserts and tips. The $\frac{5}{16}$ by $\frac{3}{4}$ by 1-inch tip was brazed on a 1 by 2-inch shank. It had a 12-deg lead angle, 0-deg top rake and a 0.02 by 0.120-inch chip breaker. Inserts, $\frac{3}{4}$ inch square by $1\frac{1}{2}$ inches long, had 0.02 by 0.156 chip breakers ground on opposite edges of each end. All insert holders were designed for 15-deg lead angles and –7-deg top rake.

Table 1—Production Cost Comparison—280-mm Test

Factor		Brazed	Insert
Average time required to remove 100 cu inches stock with continuous cutting,	hours	1.29	1.00
Average actual cutting time per 8-hour shift after allowances,	hours	5.00	5.00
Average amount of stock removed per machine per shift,	cu inches	3876	5000
Time to remove 484.5 cu inches stock,	hour	1.000	0.775
Average time saved per month,	hours	...	108
Labor costs, at $9.90, saved per month,	dollars	...	1069.20

Speeds and feeds were varied to obtain optimum conditions with the particular tool being used and with respect to work diameter and material hardness. Average conditions were: cutting speed, brazed 145 fpm, insert 152 fpm; feed, brazed 0.0312 ipr, insert 0.0292 ipr; and depth of cut, brazed 0.2382 inch, insert 0.3124 inch.

Based on the production and cost comparisons, TABLES 1 and 2, it was apparent that insert tools would save both time and money. With the production rates called for on 280-mm gun jackets and

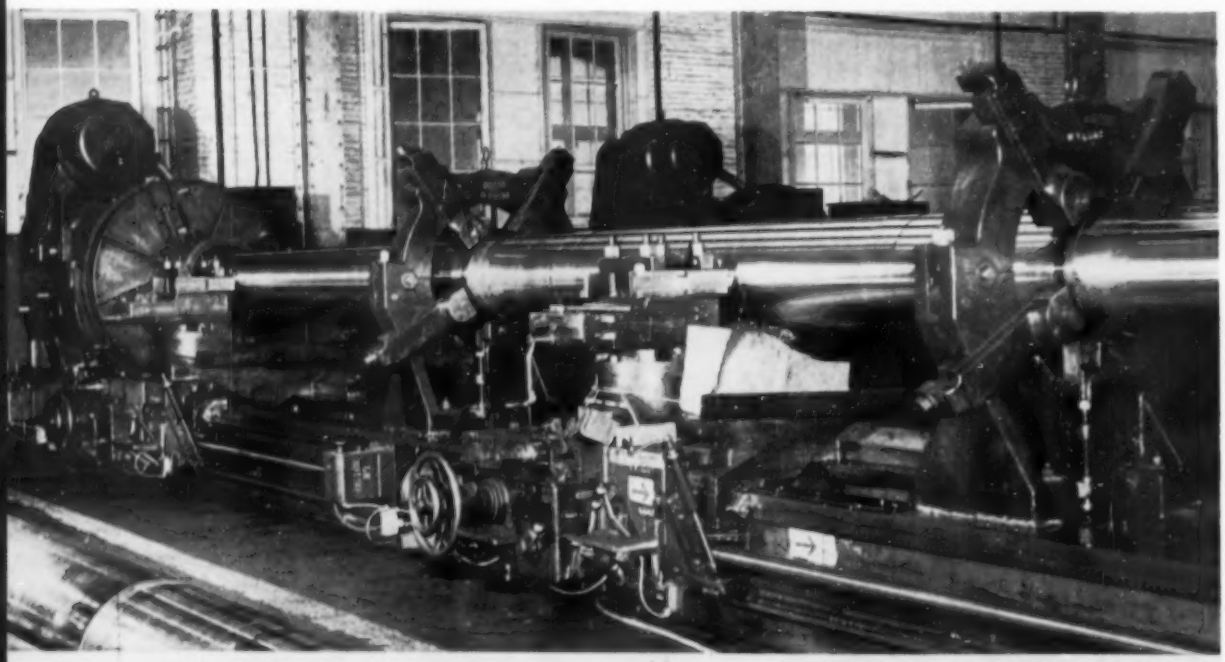


Fig. 2. Gun tube turned during tests to determine if brazed or clamped-insert tools were more economical.

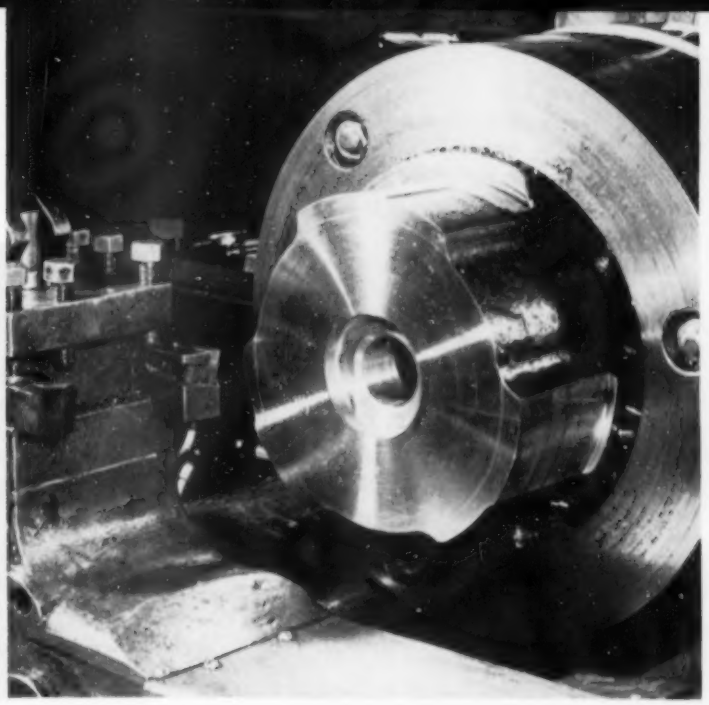


Fig. 3. Severe interrupted cuts on the major-step thread diameter of 155-mm-howitzer breech blocks gave a good opportunity to compare brazed and insert type tools.

tubes, monthly savings could amount to $2276.40 if brazed tools were replaced by insert tools.

A production problem encountered in machining the major step-thread diameter of a 155-mm-howitzer breech block, *Fig.* 3, brought about the second testing program with carbide insert tooling. This operation involved a severe interrupted cut, resulting in excessive breakage of the brazed tools used.

Table 2—Tool Cost Comparison—280-mm Test

Characteristic or Operation		Brazed	Insert
Prepare shank (same for retipping),	minutes	9.5	...
Braze tip to shank,	minutes	3.2	...
Original grind,	minutes	8.0	...
Grind four chip breakers,	minutes	...	20.0
Regrind (6 at 8 minutes),	minutes	48.0	...
Regrind (11 both ends and 4 chip breakers),	minutes	...	440.0
Tips used during life of one shank,	number	7	...
Tool processing time for one shank and 7 tips (7 x 68.7),	hours	8.015	...
Tool processing time for each expended insert,	hours	...	7.67
Labor cost per hour,	dollars	2.30	2.30
Labor cost for tool processing,	dollars	18.43	17.64
Shank cost,	dollar	0.81	...
Tip cost (7),	dollars	15.12	...
Brazing shim cost (7),	dollar	0.84	...
Insert cost (1)	dollars	...	13.51
Labor and material costs,	dollars	35.20	31.15
Expended edges,	number	49	48
Cost per expended edge,	dollar	0.72	0.65
Edges used per day,	number	138	60
Daily tool cost,	dollars	99.36	39.00
Tool cost savings per month,	dollars	...	1207.20

Tool breakage was reduced by limiting the depth of cut but it was still high. Triangular inserts of several carbide grades, in mechanical type holders, were then tested to see if tool breakage could be further reduced. Tools were evaluated on the basis of tool life, production rate, tool and production costs, and over-all performance. Toolholders were evaluated on the basis of general performance.

Tests on the 155-mm breech block extended over a period of five months. A total of 372 insert edges and 28 brazed tool edges was expended during the comparison tests. Insert tools resulted in lower tool costs, increased production rates and no breakage. Upon completion of these tests, insert tools were immediately adopted for this operation and considerable savings were realized.

The breech block was rough and finish turned on a turret lathe. Approximately $\frac{3}{4}$ inch of 255-302 Bhn alloy steel was removed from each of the three thread segments, $1\frac{1}{2}$ inches on the diameter, for a length of $3\frac{7}{8}$ inches. All cuts were made dry. With the brazed tool, the optimum operating procedure comprised four roughing cuts and one finishing cut. With this procedure, two components were machined per tool edge expended. Estimated tip costs are listed in TABLE 3. The optimum operating procedure for insert tools consisted of one roughing cut and one finishing cut. Two components were machined per tool edge expended. Estimated insert costs are shown in TABLE 4 for the four grades of carbides used as inserts.

The brazed tool had a $\frac{1}{4}$ by $\frac{1}{2}$ by $\frac{3}{4}$-inch carbide tip with a 0.025-inch radius. Tips were set with zero lead and top-rake angles, and had 0.02 by 0.085-inch chip breakers. Tips were brazed on

1¼ by 1¼-inch offset shanks. Triangular inserts, ½-inch IC by ½ inches long, had 1/16-inch nose radii and no chip breaker. Lead angle was zero and top rake was −7 deg. These inserts were used with right-hand band type toolholders.

With standard times for the two types of tools, TABLE 5, and with a basic labor cost of $7.70, the production cost savings for 1215 breech blocks would be: 1215 x 7.70 x 0.57 = $5332.64. Based on TABLE 4, Inserts 1 and 2 would be used for the breech-block job. Tool-cost savings resulting from use of inserts for a run of 1215 blocks would be: 0.212 x 1215 = $257.58. Total savings for a run of 1215 breech blocks would be $5590.22 if insert tools were used instead of brazed tools.

The switch from brazed to insert type tools gave increased production, reduced costs and other benefits. Because inserts are mechanically held, insert type tools have none of the disadvantages of brazed tools. Each insert type tool has four to eight cutting edges and can do the work of four to eight brazed tools so that transportation time, handling and storage of tools are reduced about 80 percent. Insert type tools can be set in the machine more easily and insert holders are long-lived when compared to the shanks of brazed tools.

Because of the favorable results of these tests, immediate action was taken to modernize the entire tool program at the arsenal. Insert type tools are now used wherever possible with considerable reduction in machining costs.

Table 3—Estimated Tip Costs per Breech Block

Characteristic or Operation		Value
Prepare new shank,	minutes	52
Braze tip to shank,	minutes	4
Grind and regrind tip (7x8),	minutes	56
Prepare shank for retipping (3 x 9),	minutes	27
Braze retips to shank (3 x 4),	minutes	12
Grind and regrind retips (3 x 7 x 8),	minutes	168
Processing time for expended tool,	minutes	319
Processing time for expended tool,	hours	5.32
Labor cost per hour,	dollars	2.30
Processing cost for expended tool,	dollars	12.24
Shank cost,	dollar	0.40
Carbide tips (4)	dollars	4.04
Brazing shims (4),	dollar	0.36
Total cost for one expended shank,	dollars	17.04
Edges expended (4 x 7),	number	28
Cost per edge expended,	dollar	0.608
Blocks machined,	number	56
Blocks machined per edge,	number	2
Tool cost per block,	dollar	0.304

Table 4—Estimated Insert Cost per Breech Block

Characteristic or Operation		Insert 1	Insert 2	Insert 3	Insert 4
Original grind,	minutes	5	5	5	5
Regrinds: quantity,	number	19	12	17	10
time,	minutes	285	185	260	155
Total grinding time,	hours	4.84	3.08	4.33	2.58
Labor cost per hour,	dollars	2.30	2.30	2.30	2.30
Processing cost per expended insert,	dollars	11.13	7.08	9.96	5.93
Cost of insert,	dollars	9.12	9.34	9.12	8.29
Total cost per expended insert,	dollars	20.25	16.42	19.08	14.22
Edges expended,	number	120	78	108	66
Cost per edge,	dollar	0.169	0.210	0.177	0.215
Blocks machined,	number	225	174	167	89
Blocks machined per expended edge,	number	1.88	2.23	1.55	1.35
Tool cost per block,	dollar	0.090	0.094	0.114	0.159

Table 5—Standard Times per Breech Block for Two Tool Types

Characteristic or Operation		Brazed Tool Methods	Insert Tool Methods
Machining time,	minutes	38.73	15.49
Manual time,	minutes	8.57	2.32
Tool allowance per piece,	minute	1.00	0.81
Allowance (fatigue, personal),	minutes	7.75	2.98
Standard time per piece,	minutes	56.05	21.60
Standard time per piece,	hour	0.93	0.36

Steel Production from Card Control

Adaptation of card programming has been turned to the steel industry with Allegheny Ludlum's use of the system in producing electrical steels. Installed on a reversing roughing mill, the preset control system is capable of controlling 15 programmed passes from a single card at accuracies of approximately 0.01 inch.

The control, developed by General Electric's Engineering Laboratory, utilizes an electronic counter which is preset by punched card data to regulate the screwdown position. Manual adjustment is unnecessary as the system itself controls setting and speed of the rolls.

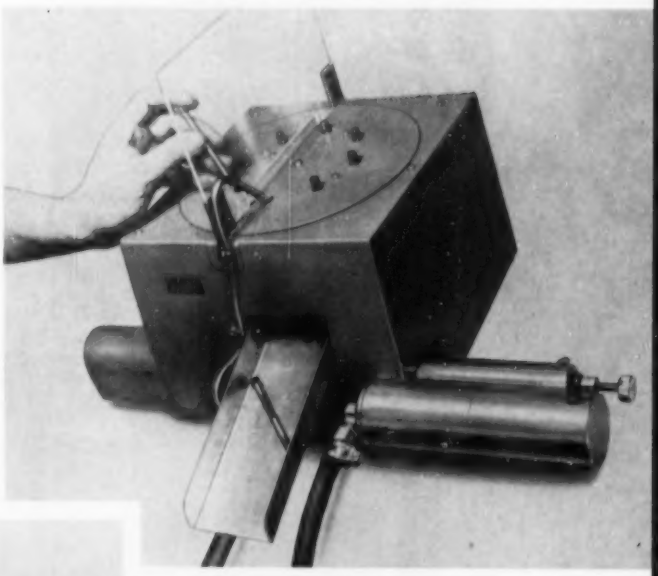
After the proper card has been inserted into the card reader, it is necessary only to actuate the mill by pressing a button. Rolls now are positioned accurately and there is no performance variation because of different operators.

designed for

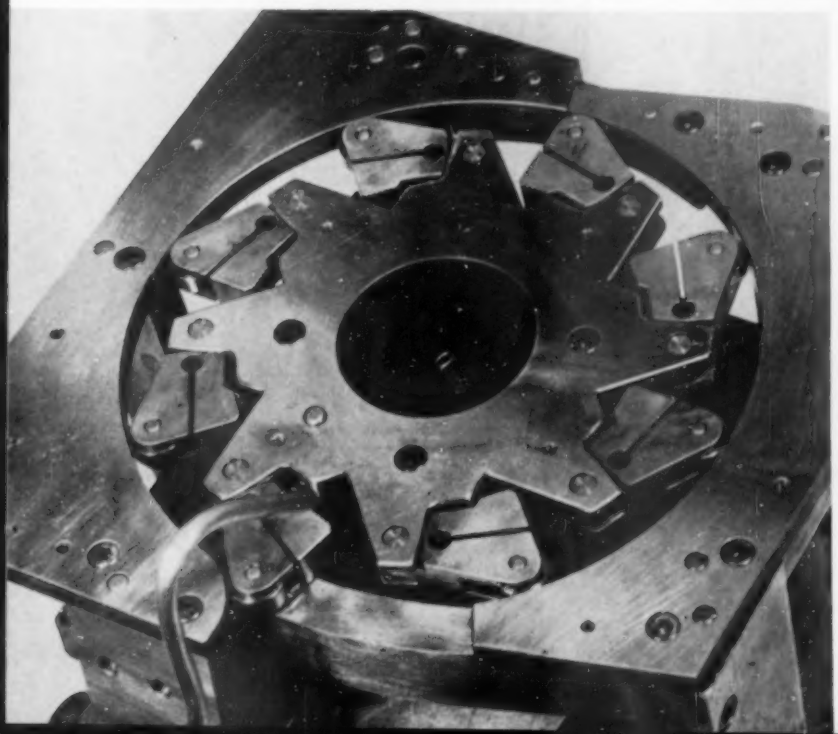
PRODUCTION

Milling Fixture Holds Parts For Two Straddle Cuts

A special fixture is required when straddle milling square heads on cylindrical parts. When the heads must be accurate, parts must be held securely while they are moved from one cutting station to the other. It is not enough just to clamp the part at each station. Amco Machine Products, Inc., solved such a problem by constructing a multiclamp fixture on the dial plate of a Mead rotary indexing table. A combination of pneumatic and hydraulic pressure imparts uniform, controlled rotation to the table.

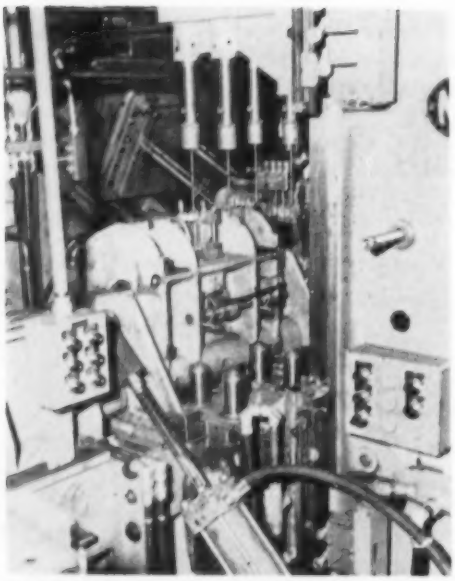


TWO SETS of straddle cutters are positioned over this fixture to mill square ends on cylindrical parts that project through holes in the top. The metal cover keeps chips out of the operating mechanism while the clear plastic shield protects the operator's hands.



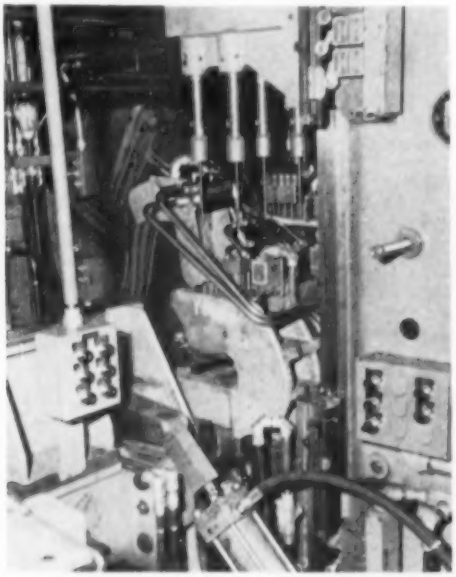
WORKPIECES are held by eight special clamps, each of which is equipped with a roller. The clamps are held closed by action of the rollers against their restraining track, except at the loading-unloading station where they are free to swing open. Finished parts are ejected into a chute at this point in the cycle, assisted by an air blast that also blows away chips.

Broaches Transferred Mechanically

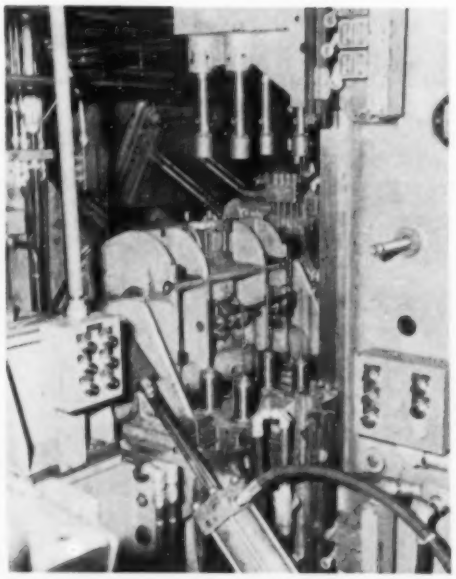


FOUR BROACHES are held by detents in upper collets while broaching fixture tilts to remove two bearing caps from the transfer mechanism.

IN addition to moving the workpiece from station to station, a bearing-cap manufacturing machine also transfers some of the tools. Top ends of four broaches, for elongating the holes in two caps, are released at the end of the cutting stroke. The broaches are then pulled from the holes by their lower ends. Before this machine was developed by National Automatic Tool Co., Inc., broaches were usually removed by hand in operations such as this.



FIXTURE returns to broaching position so broaches can be fed through drilled holes. Lower ends of broaches are clamped by lower collets during cut.



UPPER COLLETS retract so fixture can return caps to transfer mechanism. Upper collets then descend to retrieve broaches for next cut on another set of caps.

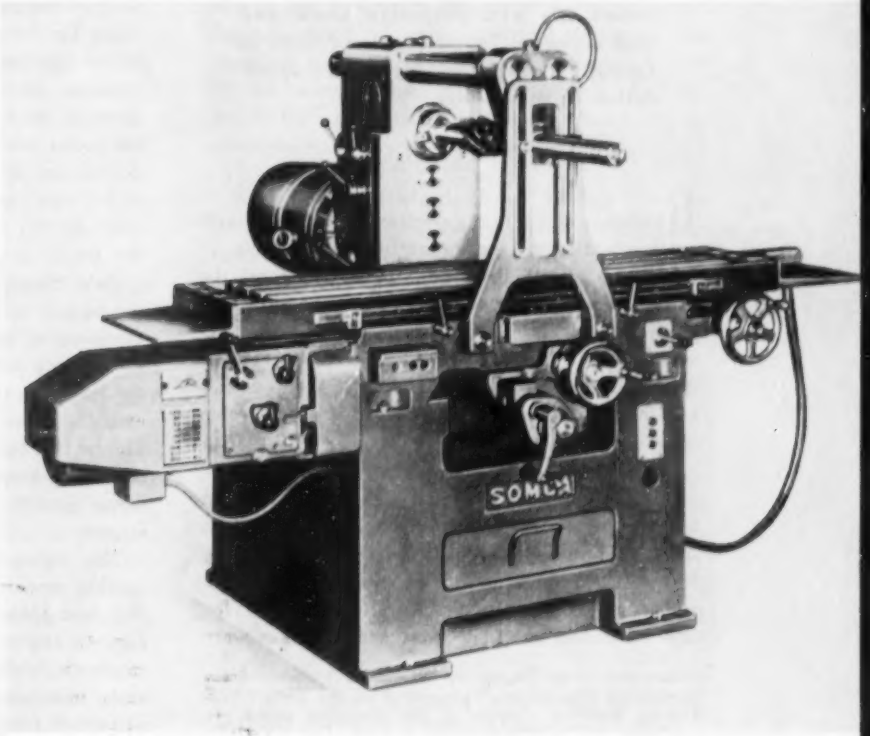
Milling Machine Departs from Traditional Configuration

Designed to basic mechanical principles rather than with traditional arrangement and configurations of major components, this milling machine looks something like a modified bed type miller. Users report it combines the performance of a plain or horizontal milling machine with the advantages of a bed type machine. Engineers of the French machine-tool builder, Saviem, determined that improvements in performance and savings during construction would result from a new approach to milling machine design.

This machine includes cross travel, has a slender upright and dispenses with the usual overhanging knee. The table rests directly on the bed and is supported along its entire length. The knee slides horizontally in the bed, which supports its entire length regardless of its position during cross motion. The spindle-supporting upright slides in long vertical guides fitted to the knee.

Another advantage of this miller is the short distance over which power is transmitted. Because of this short distance, problems of elastic torque are lessened. Operation of this machine is easy because vertically moving masses have been reduced and all controls are grouped at the front.

The upright head also serves as the spindle gearbox and supports the braked driving motor. Its dimensions were carefully computed to combine maximum rigidity with uniform distribution of internal strains arising from cutting.



MILLING MACHINE, here set up for horizontal operation, can be used for vertical milling. Laboratory tests and production work have shown that this slender upright head offers good resistance to cutting stresses and the causes of vibration because none of the metal is mechanically superfluous.

Hidden Troublemakers

. . . residual machining stresses

By Erik K. Henriksen

Project Manufacturing Research Engineer
Convair Div.
General Dynamics Corp.
Fort Worth, Texas

Systematic study of the stresses imparted to production parts by machining operations was started as recently as 1933. The author discusses his own extensive work and that reported by other researchers in laying a foundation for future application of the results.

RESIDUAL MACHINING STRESSES did not attract much attention during the early years of their investigation. They had little or no effect on the workpiece and, for that reason, were not bothering production or design engineers in industry. Research was continued, however, to try to understand the propagation and effects of such stresses but these findings were like the "cure for which there is no illness."

Attention was dramatically focused on this subject when high-strength, temperature-resistant and heat-treated materials started to be machined in large quantities. Warping, dishing and cupping during machining, and failure during use gave evidence of serious problems. Requirements for close tolerances and high resistance to fatigue were not being met. Source of the troubles was traced to the high residual machining stresses induced in work-hardenable materials now being used in quantity.

Abstracted from Paper 9, "Residual Stresses from Machining Operations," presented at the 25th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

Origin of Machining Stresses: It is convenient to consider a single-point tool cutting orthogonally, where the depth of cut is equivalent to the feed in ordinary side cutting. Since there is no such thing as a mathematically sharp tool edge in practice, a cross section through the tool shows the edge as a curve, *Fig.* 2.

There are normal and frictional forces between the chip and the tool and, because the edge is not mathematically sharp, there are also normal and frictional forces between the tool and the work. If they are large enough, the friction forces may cause the metal to flow. They may also partially create the internal deformation, which has been found in numerous photomicrographs, in the structures of the chip and the work. Flow pattern of the metal across the tool edge is indicated by the dotted line in *Fig.* 3. This flow can be described as a "drag" across the edge and explains, at least qualitatively, the formation of tensile stresses in the layers immediately below machined surfaces.

This effect is localized around the edge and does not appear to have any relation to the depth or thickness of the cut. There is, however, a strong relationship between the thickness of the cut and the resulting stress, and it is suggested that there exists a stress distribution from the shear plane, around the tool edge and into the workpiece, *Fig.* 3. As the thickness of cut increases, stresses penetrate deeper into the workpiece and residual stresses are larger.

This explanation has recently been confirmed by another researcher who has shown that forces on the shear plane can be supported by two columns, *Fig.* 4, one of which is loaded in tension and enters the workpiece. This "pull" and the previously mentioned drag combine to explain the existence of tensile stresses in and below machined

Fig. 1. Magnified view of a machined, mild steel surface gives visible evidence of residual stresses and resulting material flow.

surfaces. It is possible that other factors also contribute to this effect. The normal force, N_2 in *Fig.* 2, has a burnishing effect on the surface and, if it is strong enough, may produce compressive stresses in the same manner as a roller or a burnishing tool.

Heat resulting from a cutting operation may induce stresses in two different ways. A concentrated source of heat will make the material expand locally. Expansion is restricted by the cooler surrounding material and the heated material will be squeezed and may flow. When the heat source is removed, the metal will cool and tend to contract. Since it was squeezed, it has become too small and, because it is locked to the surrounding material, it cannot contract to its natural size. That this material will remain stressed in tension has been experimentally confirmed.

Cutting temperatures may also be high enough to cause metallurgical changes in the metal. If such changes result in an increase in volume, there will be compression; if the volume is reduced, there will be tension. This effect has been suggested as a possible factor in the production of grinding stresses.

Mechanism of Stress Formation: Methods of stress formation can be studied by considering a straight, flat piece held rigidly in a vise during a planing or shaping operation. To simplify the investigation, it can be assumed that effects of heat and N_2 can be ignored. The only stress-producing factor is the combination of drag and pull.

In the moment it is produced, the residual stress will be one of tension. It is reasonable to assume that this stress will be maximum at the surface and taper off to zero at some depth below the surface. This stress distribution cannot be in equilibrium by itself. With the forces exerted by the vise jaws, however, equilibrium does exist. When the workpiece is released from the vise, the stressed side will contract, the piece will be shorter and curved, and deformation will continue until a set of relaxation stresses has developed so far that they are in equilibrium with the maximum stress initially set. The resulting stress distribution in the piece is obtained by combining the two sets of stresses.

The original maximum stress is reduced by the relaxation stress, but the latter is usually considerably smaller. The resulting stress is concentrated in a thin layer near the surface (except with strongly work-hardenable materials such as stainless steel) and can be of the order of 60,000 to 100,000 psi. If the area containing the resultant of all stresses near the surface is considered for a 1-inch width, the resultant stress is measured in pounds per inch.

This resultant stress is a measure of the overall stress effect. It indicates the warpage that can occur in the workpiece and, when omitted as it usually is, represents the error in experimental determinations of other residual stresses. The resultant stress is also significant since it may be the cause of dimensional instability, and can lower both fatigue strength and corrosion resistance.

Stresses from Single-Point Tools: The simplest example of machining stress determination involves an end-cutting tool used in orthogonal cutting. Significant variables, when cutting carbon

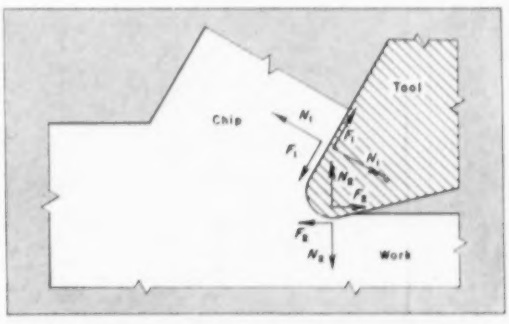


Fig. 2. Friction and normal forces acting on the chip, tool and workpiece during an orthogonal cut.

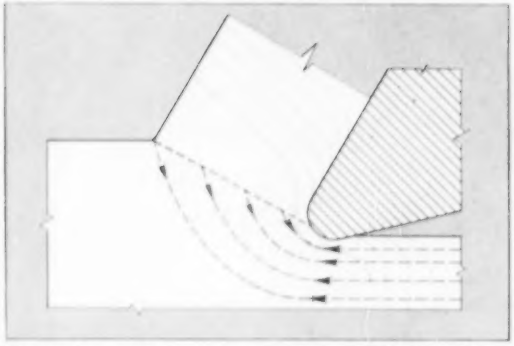


Fig. 3. Material flow around the tool edge during an orthogonal cut is indicated by the colored line. The dashed lines indicate stress flow around the tool edge.

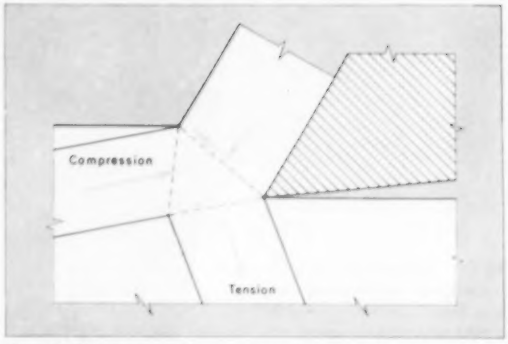


Fig. 4. Diagram of stress components in the cutting process, based on work of R. Hill, helps explain existence of tensile stresses below machined surfaces.

steel, have been found to be normal rake angle, depth of cut and carbon content. All material was initially free of stresses, and tests were made on a shaper with HSS tools and a cutting speed of 15.7 fpm. Test results are shown in *Fig.* 5 and can be summarized by a simple statement. Resultant stress increases as the normal rake angle decreases, the depth of cut increases or the carbon content decreases.

Additional tests were run to study the possible effect of the tool relief angle. This angle was varied between ½ and 8 deg without any visible effect. The previously described tests were made with tools having relief angles of 8 deg. These tests are of interest as a fundamental study of machining stresses but data for tests with side-cutting tools have more practical application.

Preliminary tests with edge-cutting tools showed that depth of cut has no influence except for very small values (less than 0.016 inch) when the stress begins to increase slightly. The nose radius and the end-cutting edge angle have some effect. Stresses decrease with increasing nose radii and decreasing end-cutting edge angles. From the general behavior of the induced stresses, it was concluded that the side-cutting edge angle would have no effect.

A large number of tests were made under the following conditions:

Constants	
Side-cutting edge angle, deg	45
End-cutting edge angle, deg	45
Nose radius, inch	0.040
Depth of cut, inch	0.020
Cutting speed, fpm	28.9
Variables	
Normal rake angle, deg	6, 12, 24 and 30
Feed, inch per stroke	0.008 to 0.040
Carbon content, percent	0.35, 0.50 and 0.70

There was little difference between the results for the two higher carbon steels but the 0.35-C steel showed significantly higher stresses.

Increasing feed resulted in increasing residual stress, in the same manner as increasing depth of cut in orthogonal cutting. As the rake angle was increased, the stress became less, just as in the

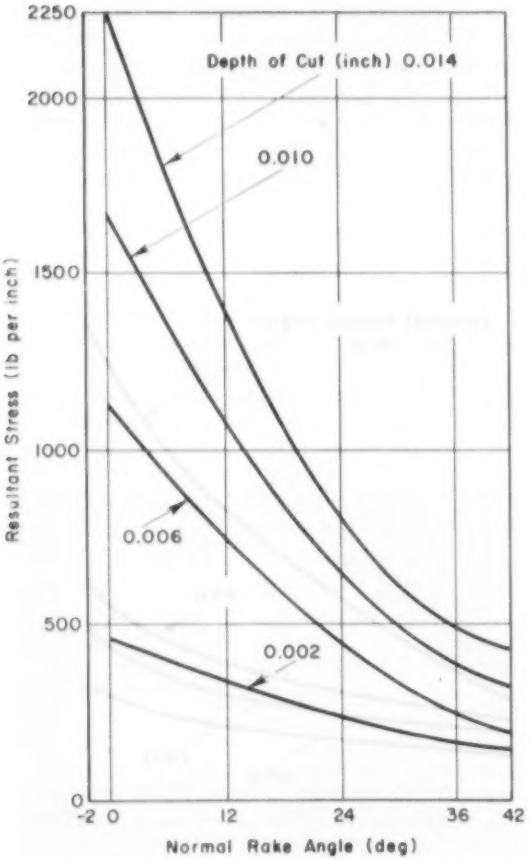


Fig. 5. Black lines indicate variation in machining stress as influenced by normal rake angle and depth of cut. Carbon content of the workpieces used in these tests was 0.10 percent. Colored lines show variation resulting from normal rake angle and carbon content changes. Depth of cut for these tests was 0.008 inch.

previous tests with end-cutting tools. With edge-cutting tools, however, a minimum stress value was reached and stress began to increase as the rake ankle was made larger. Although this phenomenon has not been explained yet, it should be borne in mind. When minimum residual stress is important, the normal rake angle should be 18 deg for edge-cutting tools.

Stresses considered to this point have been in the direction of cut. With a side-cutting tool, the cutting process at the finished surface is actually shear cutting. For this, and probably other reasons too, there is a stress component at right angles to the direction of cut. In other words, the stress is two-dimensional, *Fig.* 6. The cross component is much less than the straight component.

Most of the tests were made with shop tools, a few of which were worn. These tests showed lower tensile stress than that induced by sharp tools. This is explained as an effect of the normal force, N_2 in *Fig.* 2. This force is larger for a worn tool. Such a tool has a burnishing effect, which produces compressive stresses. In these tests, the tensile stress is still dominant but it is somewhat reduced by the compressive stress component. With badly worn tools, the resultant stress might be compressive rather than tensile.

All tests were run dry except for a single case in which the tests was made with the piece completely under water. The stress was the same as with dry cutting and it can be concluded that residual stresses are entirely mechanical in origin. Temperature is not a significant factor at low and medium cutting speeds. Some tests were made with ring-shaped pieces in a lathe. With such a setup, it was possible to study the effects of cutting speeds up to 344 fpm. Increased speeds result in lower stresses. The heavier the feed, the sooner the stress values drop with increasing speed.

Austenitic stainless steel of the 18-8 type has a capacity for stress accumulation not found in other materials. When a cut is repeated under identical conditions, the second cut results in a higher residual stress than the first. After a number of cuts, the stress value levels off and then tends to decrease slightly. Results of a large number of tests showed the same characteristic pattern.

This behavior can be explained by assuming that the material work hardens to a considerable depth through the action of the cutting tool. The first cut is taken in undisturbed material. The second cut is taken in work-hardened material and the stress effect is greater. This accumulation of stress continues to a certain limit that is independent of the cutting conditions. The maximum stress was found to be of the order of 4750 to 5870 lb per inch, four to five times greater than found with carbon steels cut under similar conditions. Maximum stress occurred after removal of about 0.2 inch of stock, regardless of the number of cuts or their individual depths. The stress, after the first cut, would increase with feed as well as with depth of cut.

Reason for the reversal of the stress curve is simply that the stresses plotted were calculated from the assumption that the stressed layer is infinitely thin and concentrated in the surface. This assumption was correct for carbon steels but is inadequate for these stainless steels. The resultant of the stresses is located well below the surface. The shape of the curve permits calculation of the true location of the stress resultant as well as its correct size.

This work has led to some practical conclusions for machining stainless steel. Austenitic stainless steel parts should be designed with the least possible machining allowance. This allowance should be removed in one cut with a fine feed. Ferritic stainless steel does not behave in the same manner. Stresses are small; in effect they are only ¼ to ½ of those formed in carbon steel under the same cutting conditions.

Austenitic manganese steel and cast iron result in compressive stresses. Armco iron shows higher stresses than those obtained with low-carbon steels. Free-machining steels have lower stresses than those induced in equivalent carbon steels. Cast carbon steel results in stress data approximately the same as those found for rolled steel, except that it has a higher sensitivity to depth of cut and rake angle. Minimum stress was achieved with an 18-deg rake angle.

Stresses from Milling Cutters: Other researchers have investigated the stresses induced

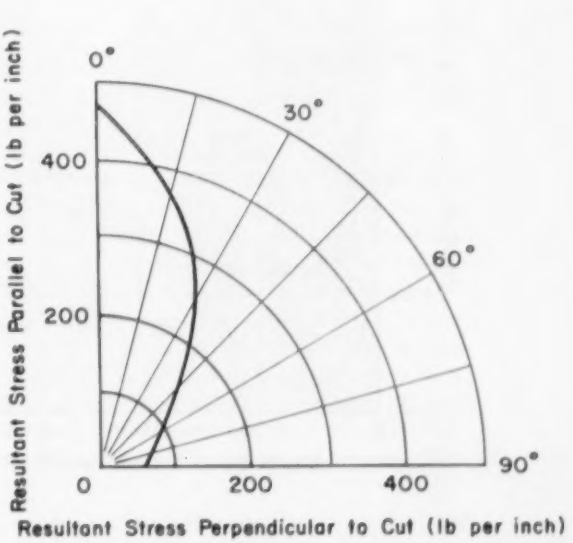


Fig. 6. Variation of residual machining stress in relation to the direction of cut for a side-cutting tool.

by various types of milling cutters working in AISI E4340 steel heat treated to 200 Bhn. They determined the real stress in pounds per square inch by etching off thin layers and measuring the bending deformation after each etch. Their results are summarized in *Fig.* 7. With the side mill, the measured stress component is in the direction of cut; with the others, it is perpendicular to the direction of cut. In all cases, the measured stress was in the direction of feed.

These curves show that high stresses are concentrated in thin layers below the surface and, in all cases, the resultant stress is compressive. The curves look much like stress patterns found with some grinding operations.

Grinding Stresses in Steel: Research in induced grinding stresses has shown an almost confusing variety in results. This can be explained by the large variation in the compositions and hardnesses of the steels investigated. It is possible, however, to note a trend in the results when they are correlated with the four basic causes of machining stresses: drag and pull, burnishing, expansion due to heat and metallurgical changes due to heat. Residual grinding stresses are of basically the same nature as other machining stresses.

An unhardenable material, such as the low-carbon SAW 1020, results in stress distribution as shown in *Fig.* 8 when ground dry. The stress is tension, with maximum values reached at the surface and well over the normal yield point of the material. A light cut gives a larger surface stress but less penetration. Resulting stresses of 212 lb per inch for light cuts and 300 lb per inch for heavy cuts are in good agreement with results found when cutting with single-point tools.

Some published work has shown comparatively low values for the maximum residual stress. This can probably be explained by the fact that grinding conditions were severe and produced sufficient heat to partially anneal, and thereby relieve some stress in the surface.

High tensile stress values, found when dry grinding AISI 52100 steel, have been reduced when an oil-water emulsion was used as a grinding fluid. When a grinding oil was used, the tensile stress almost disappeared. With suitable grinding conditions, it is possible to produce compressive stress in the ground surface. This is advantageous since compressive surface stress is probably much less dangerous than tensile stress.

Almost all grinding stress investigations have shown that residual stresses are two-dimensional. The component across the direction of cut is always less than the one in the direction of cut. Thickness of the stressed layer is normally greater than the depth of cut and greater than the visibly deformed surface layer.

Although the stresses left in surfaces by machining operations cannot always be prevented, an understanding of how they are formed can lead to reducing their effects. If tool engineers know the way in which a part is to be stressed in service, they can plan machining operations and directions of cut so parts can meet design requirements for life. This is just one more area where tool engineers and designers can work close together to achieve optimum results with economy.

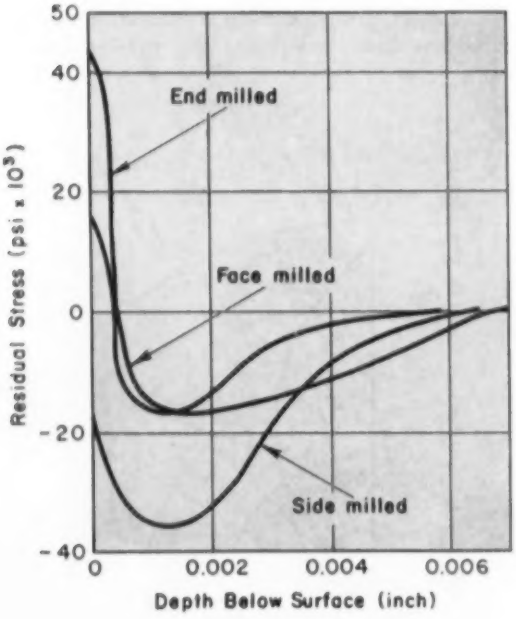
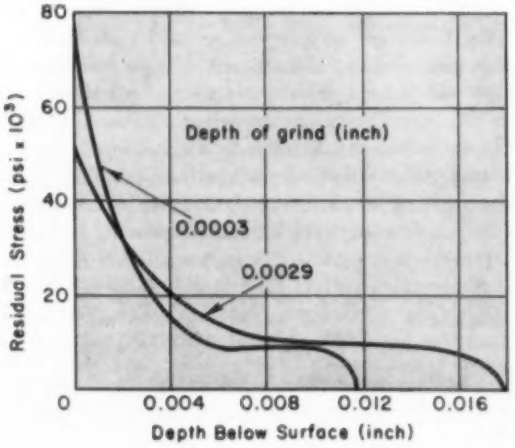


Fig. 7. (left) Milling stresses induced in 4340 steel as determined by Field and Zlatin.

Fig. 8. (below) stresses resulting from grinding low-carbon, unhardened steel, as found by J. Frisch and E. G. Thomsen.



tests compare finishes from

ceramic and carbide tools

By M. C. Shaw * and P. A. Smith *

Machine Tool Div.
Mechanical Engineering
Massachusetts Institute of Technology
Cambridge, Mass.

Demands for higher cutting speeds and greater precision have stimulated interest in carbide and ceramic tools. Tests recently conducted at MIT on finishes produced by such tools have developed much useful information on fields for application.

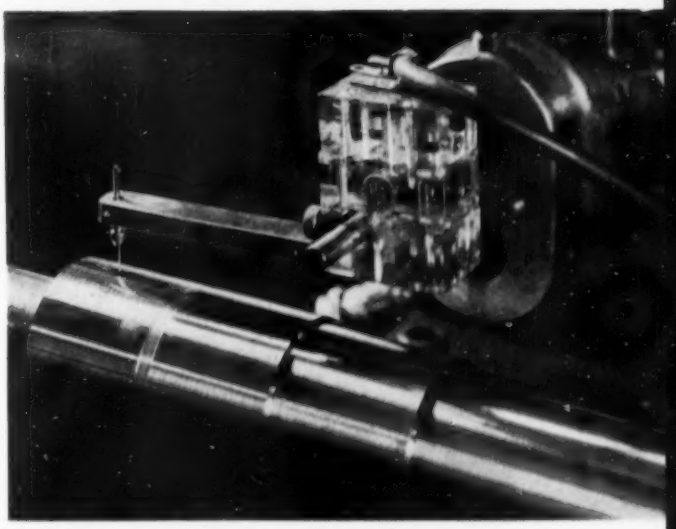


Fig. 1. Setup for testing finishes produced by ceramic and carbide cutting tools.

BEFORE CERAMIC cutting tools can be utilized to the greatest advantage in production, more must be known of their inherent characteristics and behavior under a variety of conditions. To develop comparative data on ceramic tools, studies were undertaken in the machine tool laboratories of Massachusetts Institute of Technology, *Fig.* 1. Specifically, tests were performed to determine finishes produced by ceramic and carbide tools under controlled conditions. This work was undertaken to better define the particular fields of application of each of these two tool materials.

In considering finishes produced in metal-cutting, there are several sources of roughness on machined surfaces: those due to feed marks; those due to built-up edge (BUE); those due to crack formation at the tool tip; those due to an imperfect cutting edge; those due to tool or work vibration or chatter.

Roughness due to feed marks is a function of tool geometry, feed rate and depth of cut, and can readily be computed. Roughness due to formation of a built-up edge is the type to be discussed. At low cutting speeds or temperatures many materials machine with discontinuous or semicontinuous chips

*Senior member ASTE Boston chapter.

Abstracted from Paper 20, "A Comparison of Workpiece Finishes Produced by Ceramic and Carbide Tools," presented at the 25th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

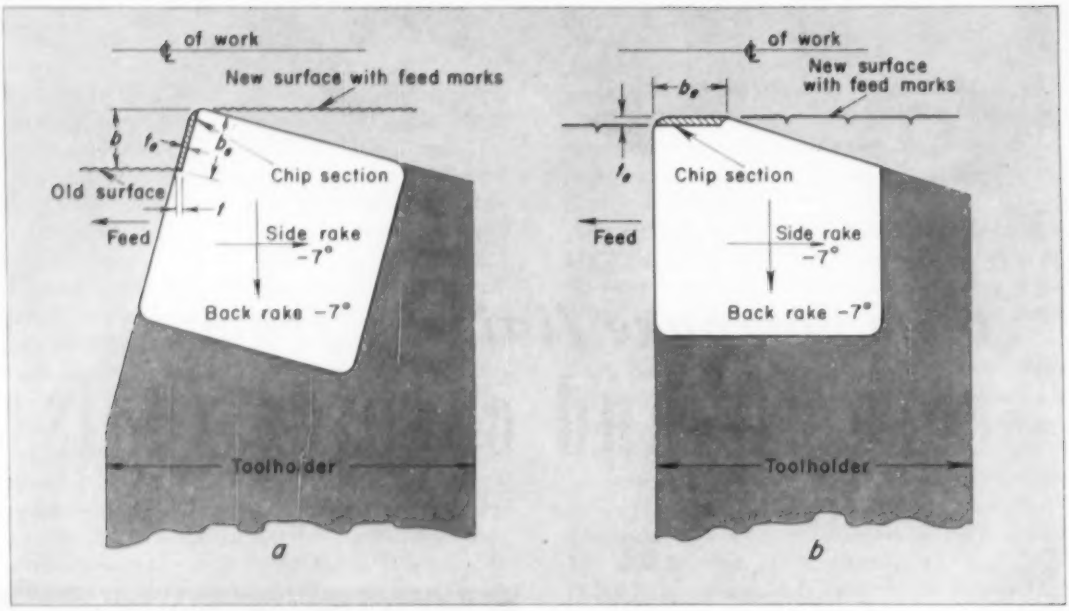


Fig. 2. Comparison of conventional tool and analog tool used for finish studies. View *a* shows conventional tool; view *b* shows plan view of analog tool.

and involve the formation of cracks which may run forward and downward from the cutting edge, thus yielding an irregular surface. A chipped cutting edge or a chattering tool will obviously produce an irregular surface.

In this study the tendencies of ceramic and tungsten carbide cutting tools to yield built-up-edge roughness are compared. Initially sharp tools sufficiently rigid to avoid chatter were used at cutting speeds generally beyond those where roughness due to crack formation is obtained.

In order to separate roughness due to feed from roughness due to built-up edge, an analog tool, *Fig.* 2, was used. A plan view of a conventional tool is shown at *a* while the analog tool is shown at *b*. The size and shape of chip that is taken in the two cases are the same, while the feed and depth of cut are interchanged. Cutting forces and lives of tools and their analogs are the same.

The chief advantage of using the analog tool lies in the fact that the surface produced by the major cutting edge is retained on the surface of the bar where it can be examined. With the conventional tool the corresponding surface is cut away as the tool advances and cannot be observed since the surface is destroyed as the work is decelerated and brought to rest.

Carbide and ceramic tools used in this investigation were $\frac{3}{8}$-inch-square clamped tools having the following dimensions:

back-rake angle, -7 deg
side-rake angle, -7 deg
end relief, 7 deg
side relief, 7 deg
end-cutting edge angle, 15 deg
side cutting edge angle, 15 deg
nose radius, 1/32 inch.

The tool materials used were: C-5 steel-cutting type tungsten carbide; commercial ceramic tool material, designated *A*; and commercial ceramic tool material, designated *B*. Ceramic tool material *A* was somewhat softer than material *B*. Two types of steel were used as workpieces in this study, each being three inches in diameter. They were AISI 1020 and AISI 4340. All cuts recorded had an axial length of one inch.

The principal variables which influence roughness due to built-up edge are: cutting speed, tool geometry (effective rake angle), feed, cutting fluid, workpiece temperature, tool material, and work material composition and structure. Cutting speed is by far the most important of these, so this study included a wide range of speeds. The rake angle was fixed at values that have proved practical for carbide and ceramic tools from a strength point of view (-7 deg.), while feed values used in this investigation were those characteristic of finishing cuts, 0.003 and 0.005 ipr. No cutting fluid was used in most of the tests, but an effective fluid was used in a few comparisons at low speed. The workpiece was at room temperature in all tests and the same bars were used for all cuts so that there was little variation in workpiece material from test to test.

Two tracer instruments were used to measure the quality of the surfaces produced. One instrument had a diamond stylus of 0.0005-inch radius of curv-

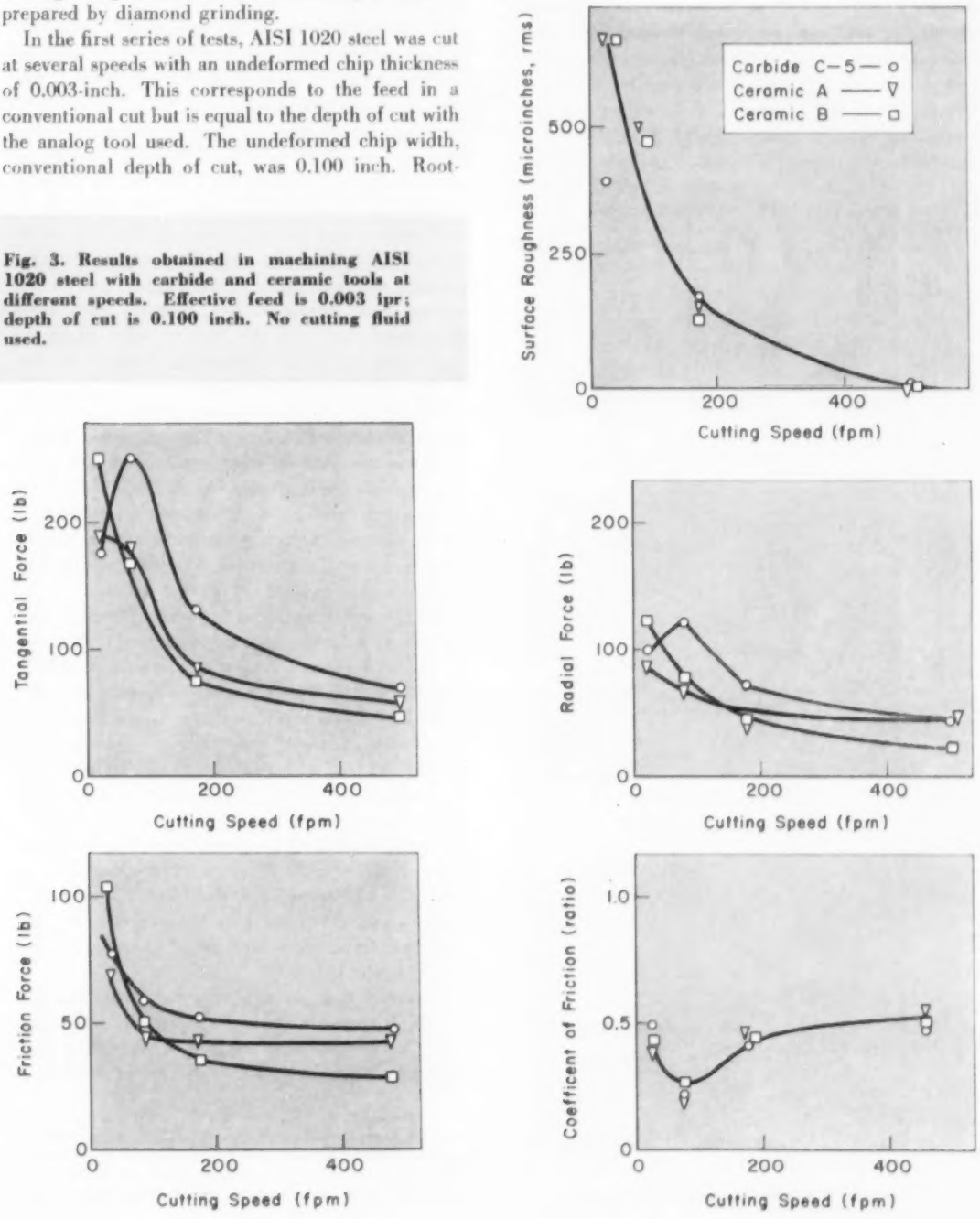
ature and yielded a root-mean-square roughness value, while the other had a steel stylus of 0.002-inch radius and produced a trace of the surface profile with a magnification of 11X in the direction of travel and 32X at right angles to the finished surface.

A typical three-component dynamometer was used in obtaining tangential (F_p) and radial (F_R) cutting force components. The axial component (F_Q) was of negligible importance for the analog tool. At the beginning of each series of tests sharp tools were prepared by diamond grinding.

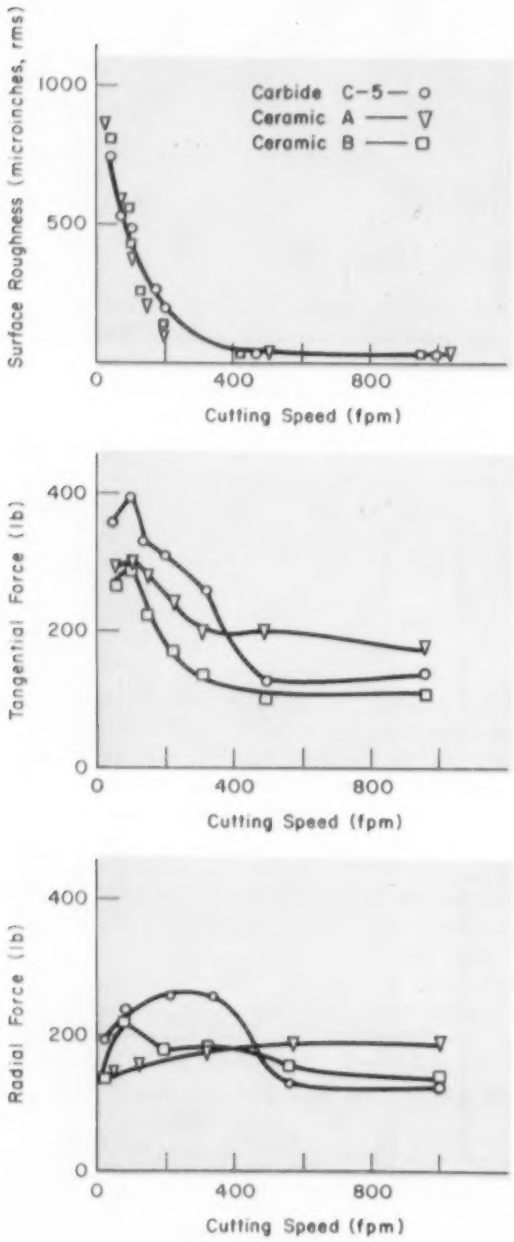
In the first series of tests, AISI 1020 steel was cut at several speeds with an undeformed chip thickness of 0.003-inch. This corresponds to the feed in a conventional cut but is equal to the depth of cut with the analog tool used. The undeformed chip width, conventional depth of cut, was 0.100 inch. Root-mean-square surface finish values, measured in a circumferential direction, are shown in *Fig.* 3, together with the cutting force components, F_p and F_R. Also shown in *Fig.* 3 are the calculated friction force on the tool face (F) and the so-called coefficient of tool-face friction which is the ratio of the friction force (F) to the normal force (N).

Surface roughness is seen to increase markedly with decrease in cutting speed, due to the formation

Fig. 3. Results obtained in machining AISI 1020 steel with carbide and ceramic tools at different speeds. Effective feed is 0.003 ipr; depth of cut is 0.100 inch. No cutting fluid used.



of a larger and larger built-up edge. At speeds above 100 fpm, there is little difference between the surface roughnesses resulting from carbide and ceramic tools. There is, however, a significant difference in the finish characteristics of ceramic and carbide tools at low speeds. The carbide tool shows a maximum roughness at a speed in the vicinity of 50 fpm. This is characteristic of both carbide and HSS tools. However, in none of the work done with ceramic tools has such a maximum been observed. The built-up edge that forms on carbide or HSS tools below 100 fpm appears to be unstable at the higher speeds of this range and fluctuates in size. That which forms on such tools at low speeds seems to to be firmly anchored to the tools and remains much more constant in size, thus yielding an improved finish at low cutting speeds. This is despite the formation of an edge of ever-increasing size. The edge that forms on ceramic tools never appears to become stabilized but fluctuates in size and hence gives rise to increasing roughness to the lowest speeds.



The power component of cutting force is seen to follow closely the values of roughness. Presence of the built-up edge can have two opposing effects on the cutting force. First, the edge will cause an increase in the effective rake angle of the tool which in turn causes a decrease in F_p at the rate of about one percent per degree change in rake angle. Second, the increased roughness of the generated surfaces, i.e., face of chip and finished surface, will give rise to greated frictional resistance and hence an increase in F_p with built-up edge. As long at the edge is unstable, the second of these effects seems to be predominant and hence F_p rises as the size of the edge and the roughness rise. However, if the edge becomes stable, as it does for a carbide tool at low cutting speed, below 50 fpm, then the rake angle effect associated with the built-up edge plays the major role and as it continues to increase in size, the cutting force will decrease.

For cutting speeds of 70 and 16 fpm, the radial force component F_R seems to fluctuate more when a large unstable built-up edge is present than when a large stable edge is present. At 16 fpm the F_R force trace for the carbide tool becomes steady sooner than in the case of the ceramic tools, thus indicating the presence of a more stable edge for carbide than for the ceramic tools at low cutting speeds.

When the cutting speed is sufficiently high that the built-up edge has virtually disappeared, the cutting forces become constant and remain essentially constant with further increase in speed. Actually, in the high-speed region, cutting forces slowly decrease with increased speed due to a decrease in tool-face friction with rise in tool-face temperature. The point at which the built-up edge disappears is more a matter of tool-face temperature than decrease of time of contact with increase in cutting speed. In cutting a thin chip, 0.003, inch, the built-up edge is retained to high speeds, 300 to 40 fpm. For a heavier cut, it would disappear at a lower speed and the force and finish curves of *Fig.* 3 would be compressed to the left.

The power component of force is less for the ceramic tools than for the carbide tool for all speeds above 50 fpm in this instance. This means that the energy consumed per unit volume of chips (U)

Fig. 4. Results obtained when AISI 1020 steel is machined with carbide and ceramic tools at different cutting speeds with an effective feed of 0.005 ipr; depth of cut is 0.100 inch. No cutting fluid used.

is also less for ceramic tools than for the carbide tool. Where the unit volume is 1 cu inch:

$$U = \frac{F_p}{b_e \ t_e}, \text{ in-lb}$$

where

b_e = effective chip width (*Fig.* 2b), inch

t_e = effective chip thickness (*Fig.* 2b), inch

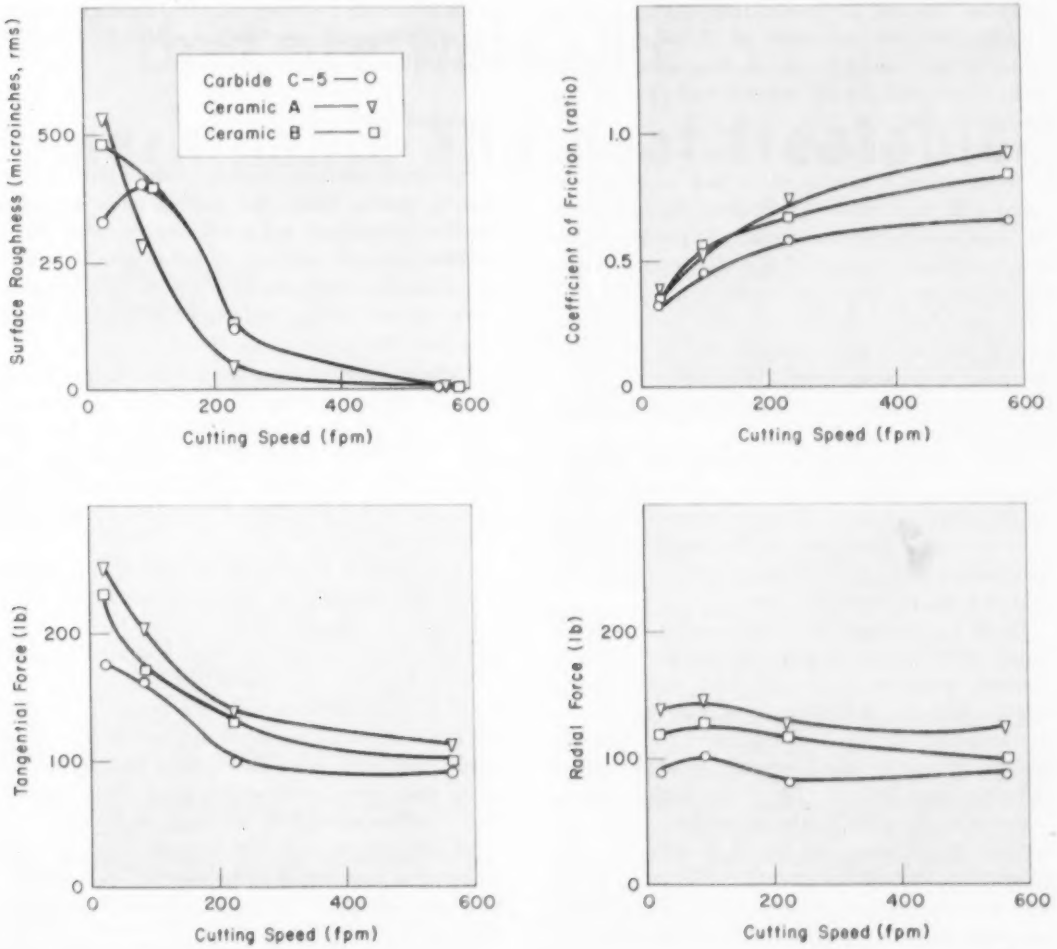
The curves of friction force on the tool face and coefficient of friction vs. cutting speed are instructive in showing that the coefficient of friction is not a good measure of the efficiency of cutting. As the cutting speed is decreased it is evident from *Fig.* 3 that:

1. The energy per unit volume increases
2. The friction force increases
3. The coefficient of friction decreases to a speed of 50 fpm.

While is it clear from considerations of energy per unit volume or surface finish that cutting becomes less efficient at lower speeds, the change in coefficient of friction would yield just the opposite opinion. The reason for this result lies in the fact coefficient of friction is not alone a measure of what happens on the tool face but also what happens on the shear plane. Thus, the coefficient of friction is not a reliable quantity to observe in comparing the performance of ceramic and carbide tools.

Results of tests on the same AISI 1020 steel with the undeformed chip thickness increased from 0.003 to 0.005 inch are given in *Fig.* 4. The surface roughness increases with decrease in speed but no maximum was observed for the carbide tool in this instance. The surface roughness plot shows that the ceramic tools lose their built-up edge at a lower speed than does the carbide tool. This is undoubtely due to the ceramic tools having a somewhat higher temperature than the carbide tool at the same cut-

Fig. 5. Results obtained when AISI 4340 steel is machined with carbide and ceramic tools at different cutting speeds. Effective feed is 0.003 ipr; depth of cut is 0.100 inch. No cutting fluid used.



ting speed under the same conditions.

This observation is supported by the nature of the chips produced by each type of tool. The carbide chips at 35 fpm were distinctly discontinuous while the ceramic chips produced at this speed were semicontinuous. Since the temperature increases when the cutting speed is increased, chips are generally found to change gradually from discontinuous to semicontinuous to fully continuous. This is due to the fact that all materials tend to behave in a more ductile fashion as their temperatures are increased.

The force values for ceramic tool *A* are higher, at speeds higher than 500 fpm, than those for the other two tools in this case. This and other tests lead to the conclusion that the power required by a ceramic tool is not necessarily less than that for a carbide tool.

Force traces clearly show the increase in cutting force associated with a decrease in cutting speed. The increase in the fluctuation of radial force with increase in built-up edge, decrease in speed, is also clearly evident. The 35-fpm test for the carbide tool gave a discontinuous chip. A cutting fluid that is normally effective at low cutting speeds, carbon tetrachloride, was introduced at 35 fpm. The decrease in the cutting forces due to cutting fluid is more pronounced for the ceramic tool than for the the carbide tool.

Results for AISI 4340 steel are presented in *Fig.* 5. Here again a maximum surface roughness is found with the carbide tool at about 50 fpm, since the chips were not discontinuous. No similar roughness maximum is observed for the ceramic tools. The cutting force curves are similar to those for AISI 1020 steel but in the present case both ceramic tools require more power than the carbide tool when operating at the same speed. The coefficient of friction again increases as the energy per unit volume or F_p decreases.

While little difference is evident between the circumferential profiles or surface roughness values for the different tools, differences between the axial profiles are clearly apparent. For example, at 200 fpm, axial profiles revealed that ceramic *A* gives the poorest finish at the highest speed.

Traces for cuts made at 15 fpm, with and without carbon tetrachloride, show that the carbide tool gave a greatly improved finish with the coolant but the ceramic tools did not. This result was opposite to that found earlier for AISI 1020 steel and suggests that the ceramic tools had been altered when operated with a large built-up edge at low cutting speeds. Traces were therefore made on the front clearance surfaces of the tool. The results showed that the carbide-tool surface was smooth, while the ceramic tools were damaged by microchipping. The damage was done at lower speeds where a large unstable built-up edge was present on the ceramic tools and caused them to chip.

The foregoing experiment was repeated, cutting the same amount of AISI 4340 steel, but this time traces were made of the front faces of the tool before and after the five inches of cutting. From these it may be concluded that ceramic tools should not be used at low cutting speeds because a large unstable edge is formed. It would therefore appear that any further study of the finishing characteristics of ceramic tools at low speeds is without practical purpose.

The fact that the built-up edge produced on a carbide tool is much more stable than that produced on a ceramic tool was dramatically illustrated by axial-profile traces of the low-speed cuts produced using carbon tetrachloride. The carbide tool gave a rough surface while the ceramic surfaces were moderately rough. When this particular carbide tool was examined it was found that it had a large built-up edge welded strongly to its top surface. This acted as the real cutting edge. The carbon tetrachloride could not remove the built-up edge which had formed earlier during dry cutting at 15 fpm. Such a strongly adhering edge that defied the action of carbon tetrachloride was never found on the ceramic tools at low cutting speed.

Conclusions

Surface finishes produced by ceramic tools at high cutting speeds, where the built-up edge is either small or nonexistent, are practically the same. While carbide tools are normally found to give a surface of maximum roughness at about 50 fpm, ceramic tools continue to give surfaces of increasing roughness with decreasing speed.

Ceramic tools tend to form a much less stable built-up edge at low speeds than do carbide tools. Partly due to this and partly due to the fact that they tend to be brittle at low temperatures, or speeds, ceramic tools are found to chip badly when operated in the presence of a large built-up edge at low speed.

Ceramic tools should not be used at low speeds either for finishing or roughing operations. The cutting-force characteristics of ceramic tools are similar to those for carbide tools. Cutting forces for ceramic tools are sometimes found to be less than those for carbide tools and vice versa. In several instances the chips produced by ceramic tools have been found to be more ductile than those produced at the same speed with carbide tools. This suggests that a somewhat higher operating temperature results with ceramic than with carbide tools. In such instances a more rapid disappearance of the built-up edge with increased speed is found for ceramic than carbide tools.

CARBIDES
...that are weldable, machinable and heat treatable

By John L. Ellis
Chief Engineer
Sintercast Corp. of America
Yonkers, N. Y.

FOR MANY YEARS, applications of cemented carbides have been retarded because of fabrication difficulties and resulting high costs. Since conventional carbides are worked with diamond wheels, major corrections of form or size of a tool are time-consuming and costly. Alternative methods of finishing special contours with standard wheels often pose serious problems which challenge the ingenuity of the diemaker or tool engineer. More often, the use of cemented carbides is avoided altogether, although their wear resistance, tool life and the resulting product quality would fully justify their use.

As a result of several years of research, a new family of cemented carbide tool and die materials has been developed. In contrast with conventional cemented tungsten carbides these materials respond to heat treatment, such as annealing and quench hardening, and can be machined in the annealed condition. In this respect they resemble tool steels. One particular type attains a hardness of approximately R_C 69 to 72 after quenching from 1750 F. When fully annealed, the hardness of the same material can be reduced to R_C 35 to 40. In this annealed condition, the carbide, *Fig.* 1, can be machined by chip-removing procedures on ordinary machine tools, using commercial high-speed steel or carbide cutting tools. In the hardened condition, these materials exhibit resistance to wear, brinelling, scuffing and abrasion.

The material has a composite metallurgical structure consisting of titanium carbide with steel as the cementing agent or binder. Titanium carbide has been selected in preference to tungsten carbide primarily for economic reasons. There is an abundant supply of raw material and processing is less expensive. As a result, the refractory, wear-resistant phase of the new material costs about 1/10 of that in cemented tungsten carbide. Steel has been

Abstracted from Paper 13, "A Machinable, Heat Treatable and Weldable Cemented Carbide for Tooling Purposes," presented at the 25th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

selected as the cementing phase because it contributes heat treatability to the composite structure. Also steel is relatively low in cost when compared with the cobalt binder used in cemented tungsten carbides.

The material is produced by a sequence of operations which start with the compacting of titanium-carbide powder in tool steel dies. The resulting porous compact is sintered at high temperature and infiltrated with molten steel under vacuum. The "densified" billet is then annealed and ready for machining. TABLE 1 compares the characteristic processing steps of the material with those for cobalt-bonded carbide.

Upper limit of carbide concentration is determined by the machinability needed in the annealed condition. Substantially harder and more wear-resistant grades are obtainable when requirements for machinability are disregarded. For example, grade A is more wear resistant in the hardened condition than grade B, as a result of its higher carbide content. In its annealed condition, however, it is at the limit of machinability. The microstructure of grade B in the annealed condition exhibits well-rounded carbide grains embedded in the steel matrix which shows spherodite. In the quenched condition, the microstructure of the binder shows fine martensite. The relatively wide separation between individual carbide grains accounts in part for the good machinability of this grade. By compacting the titanium carbide powder at a higher pressure (prior to the infiltration with molten steel) grades are obtainable with closer spacing of the carbide grains. Increases in carbide concentration, *Fig.* 2, result in harder materials, both in the annealed and hardened condition. Also, increased carbide content diminishes the hardness differential for the two conditions.

Some of the physical properties of grades A and B are shown in TABLE 2. Comparisons of the coefficient of thermal expansion and the modulus of elesticity for cemented tungsten carbide, steel bonded titanium carbide and mild steel are shown in TABLE 3. This table shows the greater compatibility of steel with the new carbide material in comparison with cemented tungsten carbide. Data indicate the possibility of creating composite tool designs

Table 1—Comparison of Characteristic Processing Steps

Processing Steps	Steel-Bonded Carbide	Cobalt-Bonded Carbide
Raw Material	Carbide powder and steel	Primarily carbide powder and cobalt
Binder addition	During furnace treatment by infiltration	Before furnace treatment by milling
Powder compacting	Low pressure to retain permeability of porous compact	Medium pressure for green strength and sinterability
Densification	By filling the pores with molten steel	By reducing pore volume resulting in shrinkage
Heat-treatability	Annealable and hardenable	None

consisting of facings of the new carbide with a steel backing. High-strength, relatively stress-free methods of attachment, which hitherto have caused a great deal of difficulty with cemented tungsten carbide, now appear feasible because of this compatibility. For example, it has been found practical to attach a grade A wear strip to steel shanks by heli-arc welding. Rest blades produced by this technique are used in a centerless grinding operation.

For the purpose of welding the material to a steel shank, stainless steel (type 310) or mild steel welding rods are preferably used. It is desirable to keep at the lowest possible temperature during the welding operation and to weld rapidly. For locating purposes, mechanical clamping is preferable to "tacking" in order to reduce the danger of crack formation. The welded component should be buried immediately in lime or other insulating material, to reduce stresses caused by rapid cooling.

Using this principle and appropriate welding techniques, a considerable variety of composite tools can be created. Wear-resistant carbide can be welded to steel core rods, mandrels, punches, fixtures, dies or machine parts. Hardening of the new material, in this case, is carried out after welding. The steel backing or shank material is selected in accordance with the heat-treating response which, during hardening of the carbide component, will produce the needed physical properties in the steel. In many cases mild steel is a satisfactory shank material.

Modulus of elasticity, TABLE 3, is another important physical property in considering composite tools, particularly where the wear-resistant component is subjected to severe mechanical stresses that cause elastic deformation. When a steel backing is required to provide support for the relatively weak wear-resistant carbide facing, proper load transmission is important to avoid cracking the carbide. Thus, a facing of steel-bonded carbide on

Fig. 1. Steel-bonded titanium carbide annealed and partially machined billets.

Table 2—Physical Properties of Steel-Bonded Titanium Carbide

Property	Grade A	Grade B
Hardness,		
as annealed (R_C)	55	40
as quenched (R_C)	75	70
Modulus of elasticity		
as annealed (10^6 psi)	36	37
as quenched (10^6 psi)	41	38
Transverse rupture strength (10^3 psi)	170-180	180-200
compressive strength (10^3 psi)	——	360
thermal expansion (10^{-6} in. /C)	10.6	12.4
Electrical resistivity		
as annealed (microhms/cm/cm²)	48	32
as quenched (microhms/cm/cm²)	55	44

Table 3—Comparison of Thermal Expansion and Modulus of Elasticity

Material	Coefficient of Thermal Expansion (10^{-6}/C)	Modulus of Elasticity (10^6 psi)
Cemented Tungsten Carbide (15% cobalt)	6.0	77
Steel Bonded Carbide (grade B)	12.4	38
Mild Steel	14.8	29

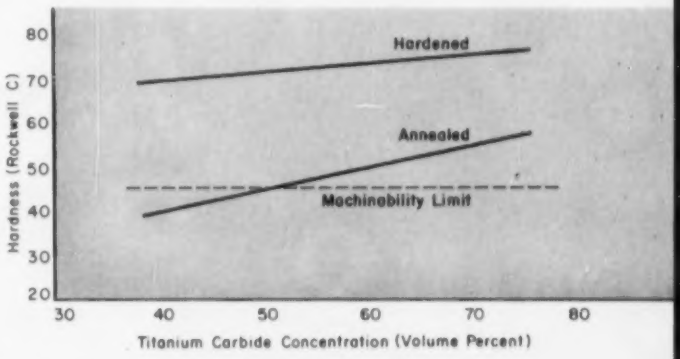


Fig. 2. Relation of hardness to carbide concentration in high-carbon, steel-bonded titanium carbide.

a composite tool can be expected to sustain a greater stress than another carbide of equivalent cross section.

Effective heat-treating cycles have been developed for simple manipulations with heat-treating equipment normally available in modern tool shops. For example, hardening of grade B is accomplished by heating the part to a temperature of 1700 F for a period of 30 minutes to 1 hour. The furnace atmosphere should be neutral or slightly carburizing. By quenching the piece in oil, a hardness of 69-71 R_C is obtainable. Back drawing after quenching does not increase the strength or toughness of the material.

Annealing of grade B is accomplished by holding the part at a temperature of 1750 F for a period of 5 hours and then cooling to 1250 F at a rate of 20 F/hr. Below 1250 F, normal furnace cooling rate is permissible. Grade B can be machined by conventiontl methods in the annealed condition, provided rigid setups and machine tools are employed.

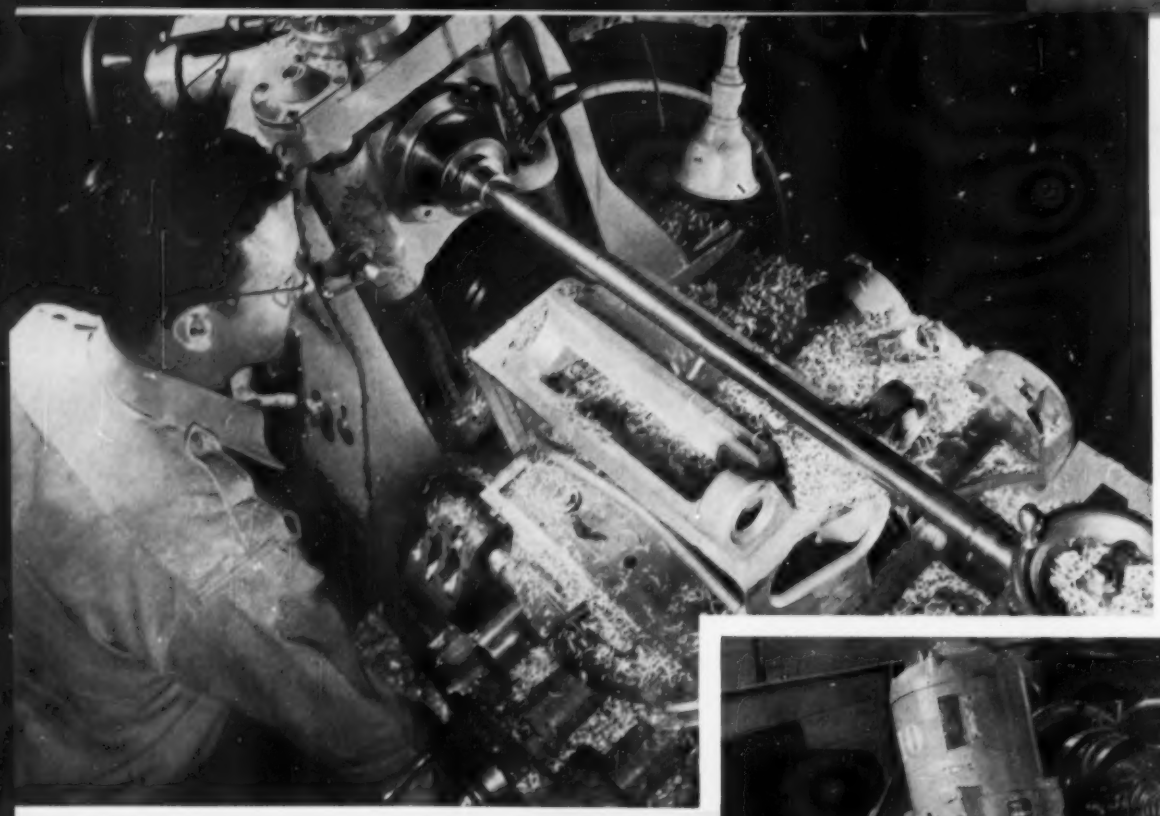
For effective lathe turning, cutting speeds should be kept below 50 fpm. For milling operations, relatively low machining speeds are required. Tungsten carbide-tipped tools produce better finish and longer tool life than high-speed tools, although the latter perform quite satisfactorily. Good results have been obtained with a band saw for slicing small grade B annealed billets. The saw blade has 14 teeth/inch and travels at less than 55 feet per minute. Improved cutting performance is obtained by increasing the blade pressure against the work.

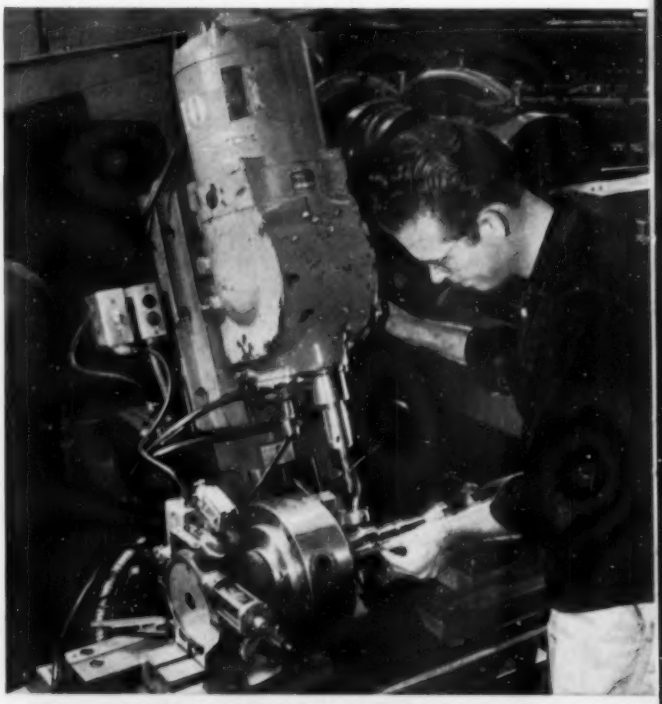
Grinding of grade B material in the annealed condition can be performed with silicon carbide wheels. Type GC 60 H 15V has proved satisfactory. Hardened grade B material is ground with either silicon-carbide or diamond wheels.

One application is the rest blade for centerless grinding. These blades are produced by welding a strip of grade A to a steel shank. When applied to rough plunge grinding of automotive valves, 56,000 pieces were ground before it was necessary to dress the wear surface. Only 2500 pieces were ground before dressing the standard cast-iron blade was necessary. In another case, through feed centerless grinding of 5000 pieces of mild steel was accomplished without sign of wear or pickup, and an excellent finish was obtained on the work.

A set of powder metallurgy compacting tools consisting of a die and punches is now being constructed from grade B. These are designed for compacting small horseshoe-shaped pellets from tungsten carbide powder in a conventional four-ton tabletting press. The die is expected to resist the abrasive action of the carbide powder during compacting. Other trial applications include composite powder metallurgy core rods, liners for crusher jaws used for crushing highly abrasive carbide and oxide agglomerates, guides for cigarette-making machines and components for atomic energy coolant pumps.

Using techniques similar to those described in this article, alloy steels with varying alloy content are infiltrated into the porous titanium carbide compact. The resulting tool material acquires correspondingly greater hardness, hot hardness and wear resistance at the sacrifice of some or all of its machinability in the annealed condition. When going to an extreme such as combining titanium carbide with high-speed steel, a very hard material is obtained which cannot be machined by chip-removing operations. Recent developments indicate the feasibility of producing precision articles from such compositions which require only finish grinding before use.



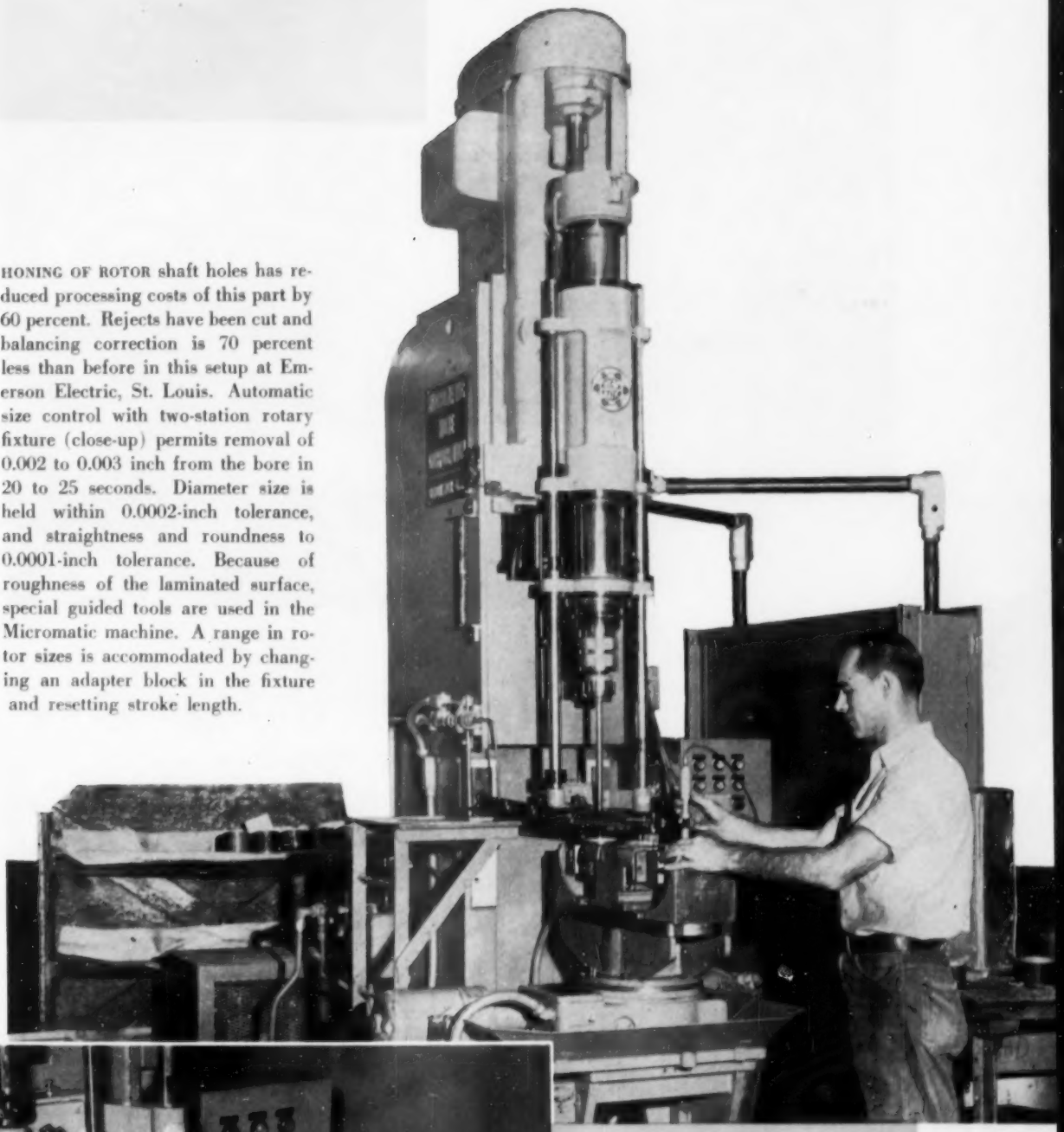


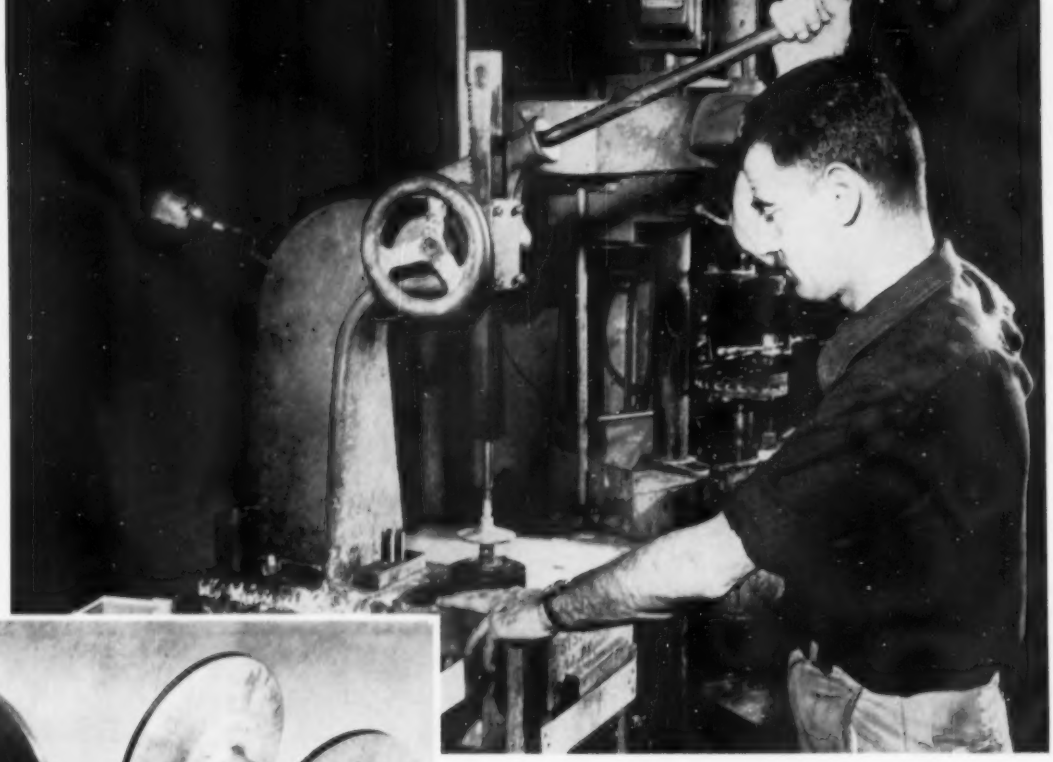
LINE BORING FIVE different diameters of an aluminum casting is expedited by this setup on a standard milling machine at Schlumberger, where quality must be maintained in short runs. The table is quickly positioned by counters that are engaged to the vertical and horizontal leadscrews. Final position can be set to 0.0001 inch using a hand-dial.

SPECIAL DRILLING machine, developed by Schlumberger Well Surveying Corp., produces wrench holes semiautomatically. Utilizing a standard drilling unit and indexing chuck, the machine is controlled by solenoid valves and precision limit switches. Coolant flow is through an adjustable bushing guide and is turned on when the drill unit advances.

TOOLS at work

HONING OF ROTOR shaft holes has reduced processing costs of this part by 60 percent. Rejects have been cut and balancing correction is 70 percent less than before in this setup at Emerson Electric, St. Louis. Automatic size control with two-station rotary fixture (close-up) permits removal of 0.002 to 0.003 inch from the bore in 20 to 25 seconds. Diameter size is held within 0.0002-inch tolerance, and straightness and roundness to 0.0001-inch tolerance. Because of roughness of the laminated surface, special guided tools are used in the Micromatic machine. A range in rotor sizes is accommodated by changing an adapter block in the fixture and resetting stroke length.





TOOLS at work

BRAZING assembles fishing reel spool in machine made by modification of two drill presses at Montague-Ocean City Rod & Reel Co. Flywheels mounted on the spindle of each press head serves as the two halves of the brazing fixture, in the opposed-head machine. Movable twin burners positioned on each side of the workpiece provide controlled heat. Weight of the upper flywheel and the drill press spindle close the joint when the silver solder melts. First step in this assembly involves pressing the spindle into one of the spools. A ring of 1/16-inch silver solder is inserted into the spool hub with the spindle. Press fit is necessary to maintain proper joint clearance between brass spool and steel spindle at brazing temperature, according to Handy & Harman engineers. Assembly is readied for joining by pressing upper half of spool on spindle. Production is 20 to 30 assemblies per hour.

TOOL ENGINEERING REPORT

Tool Engineering

REPORT

fundamentals of barrel finishing

part one - equipment and methods

By T. W. Black
Associate Editor

While barrel finishing methods are not new, they are being applied more extensively than ever before. The basic tools of the barrel finisher—barrels, media, compounds—are discussed in this first section of a two-part article, along with other factors which are important to barrel finishing performance. Part two, to be published in a subsequent issue, will discuss how to get started in barrel finishing.

BARREL FINISHING METHODS, once considered suitable only for removing burrs from small stampings and castings, have become an important means of cost reduction in many plants. Research and experimentation by the manufacturers of barrel finishing equipment and supplies, and production experience in hundred of plants have demonstrated that barrel finishing methods, properly applied, give high-precision results when used for deflashing, deburring, descaling, chamfering holes, generating controlled radii and for improving surface finish, *Fig.* 1. Accordingly, many tool engineers regard finishing barrels as precision machines, in a class with milling machines, lathes and others.

It has been shown that extremely intricate parts

can be finished in a barrel with excellent results and that close tolerances can be maintained where required. One manufacturer, for instance, is deburring precision gears by barrel finishing. The machining tolerances on the gears are 0.000050 inch. In another case, a manufacturer is using the process to generate precision radii on the corners of gage blocks. The materials which are being successfully barrel finished include ferrous and nonferrous metals, plastics, rubber and wood. Parts made of gold and other precious metals are finished in a barrel on a routine basis, as are titanium rotors for jet engines. In size, barrel finished parts range from sewing needles to 400-pound castings.

In almost every instance where barrel finishing methods have been applied, they have replaced hand filing, wire brushing or polishing or buffing operations, illustrating what is, to many, the most important advantage of barrel finishing—the elimination of costly and time-consuming hand operations. Finishing parts by the dozen, or even by thousands, in a barrel is certainly attractive from the standpoint of improved efficiency. An operator loads parts in a barrel, pushes a button, and then performs some other work while the parts are being processed.

A further significant advantage of barrel finishing is its favorable effect on product quality. It is difficult for an operator to hand-finish parts so that all parts are uniform. This difficulty is compounded when many different operators are working on the same types of parts. When parts are barrel finished, on the other hand, they are all subjected to the same conditions in the barrel, the amount of work done on each part is identical, and all finished parts are completely uniform. Some typical barrel finished parts are shown in *Fig.* 2.

Barrel Finishing Action

The action of workpieces and media in a barrel is comparatively simple. In a barrel operating with its axis in a horizontal position, *Fig.* 3, the work load continuously moves upward in the direction of rotation. When it reaches a certain point, depending on the speed of the barrel, the top layer of the load slides to the opposite side of the barrel. Although some abrading occurs as the work load rises, it has been estimated that approximately 90 percent of all grinding, deburring and burnishing action occurs during the slide. Some special barrels combine this action with a front-to-rear action.

Early efforts at barrel finishing usually involved nothing more than loading parts in a barrel and relying on a "self-tumbling" action of the parts against each other to remove scale, burrs, or flash. Today, most self-tumbling is done in conjunction with abrasive grains and water. The rubbing or sliding action of part on part, combined with the action of the abrasive and the lubricating and cleaning action of the water, results in much greater barrel finishing efficiency. This efficiency is further increased, in many cases, by the use of natural or artificial stones, shaped media and detergents or other special finishing compounds.

Barrel Finishing Operations

Basically, there are eight different types of

Photograph courtesy of Lord Chemical Corp.

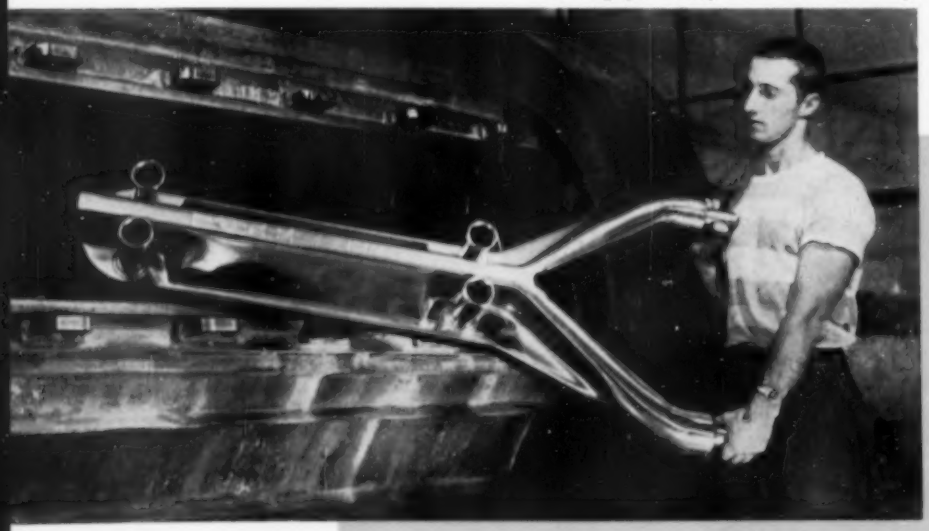


Fig. 1. Although barrel finishing operations are usually thought of as being confined to small parts, there is no factor limiting the size of parts other than the capacity of the barrel itself. The stainless steel heat-exchanger frame shown is over 57 inches long. It is barrel finished to remove grinding lines and improve surface finish.

operations which can be accomplished in a barrel. These are:

1. DEBURRING, which removes burrs caused by stamping or machining operations on metal parts
2. DEFLASHING, to remove flash from castings, forgings molded plastic parts and rubber parts
3. GRINDING, a process in which considerable material is removed to blend surfaces, form radii or remove deep irregularities from forgings, castings, stampings and machined parts
4. DESCALING, involving removal of foreign material, rust, corrosion, grease, oil, and heat treat and forging scale
5. POLISHING, the improvement of surface finish by removing small amounts of material. This process brings out the natural color of the workpiece material ("brightening")
6. BURNISHING, essentially a smoothing operation, reduces surface porosity and imparts a high luster to workpieces. No metal is removed during this operation
7. ROUGHING, used to produce a roughened surface finish or eliminate luster
8. DRYING, usually accomplished with hardwood sawdust or ground corncob meal mixtures, which absorb water and have some polishing effect.

Sometimes several of these operations are combined. Thus a deburring operation will eliminate sharp corners on workpieces and minimize machine marks and minor surface irregularities. Similarly, a grinding operation will remove burrs.

Finishing Variables

As in any industrial process, there are a number of variables which affect barrel finishing performance. These variables are:

1. Barrel type and size
2. Type and amount of media (natural stones, abrasive grains, others)
3. Use or non-use of water
4. Type and amount of compound (soap, detergent, acid, others)
5. Water hardness
6. Water level in barrel
7. Ratio of parts to media
8. Height of load in barrel
9. Rotational speeds
10. Time cycle.

Successful barrel finishing is the result of manipulating these variables in accordance with the size, weight, configuration and material of the workpiece to accomplish the desired finishing operation. Because of their importance, the variables will be discussed in some detail.

Types of Barrels: There are many types of barrels on the market. Nearly all of them can be used for general-purpose work, but some have advantages for specific operations or types of parts. Barrel types are shown in the accompanying chart.

One of the earliest types of barrels developed is the open-end tilting barrel. The axis of this type of barrel is usually 45 deg from the horizontal when the barrel is in use and the barrel can be tilted approximately 90 deg from this angle for unloading parts after the completion of the finishing cycle. Such barrels are still used extensively for self-tumbling parts and for wet-finishing of small quantities of parts, particularly where the only operation required is removal of light burrs. They are also used to remove light oil and dirt from parts in conjunction with sawdust, corncob meal or other "dry-cleaning" compounds, and to expedite drying of parts.

Photograph courtesy Norton Co.

Fig. 2. Typical small parts which have been finished in a barrel.

A variation of the tilting barrel is the "bottle barrel," which is shaped like a chemist's flask. This barrel has a small open end for loading parts, and is otherwise similar to the tilting barrel. Because of the small diameter of the opening, the barrel can be run in a horizontal position, which gives a better

tumbling action than is possible with a conventional tilting barrel.

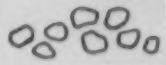
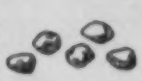
Both types of barrel are available in octagonal or round shape. Metal ribs or baffles are frequently used inside round barrels to increase the agitation of the load and keep media and parts separated.

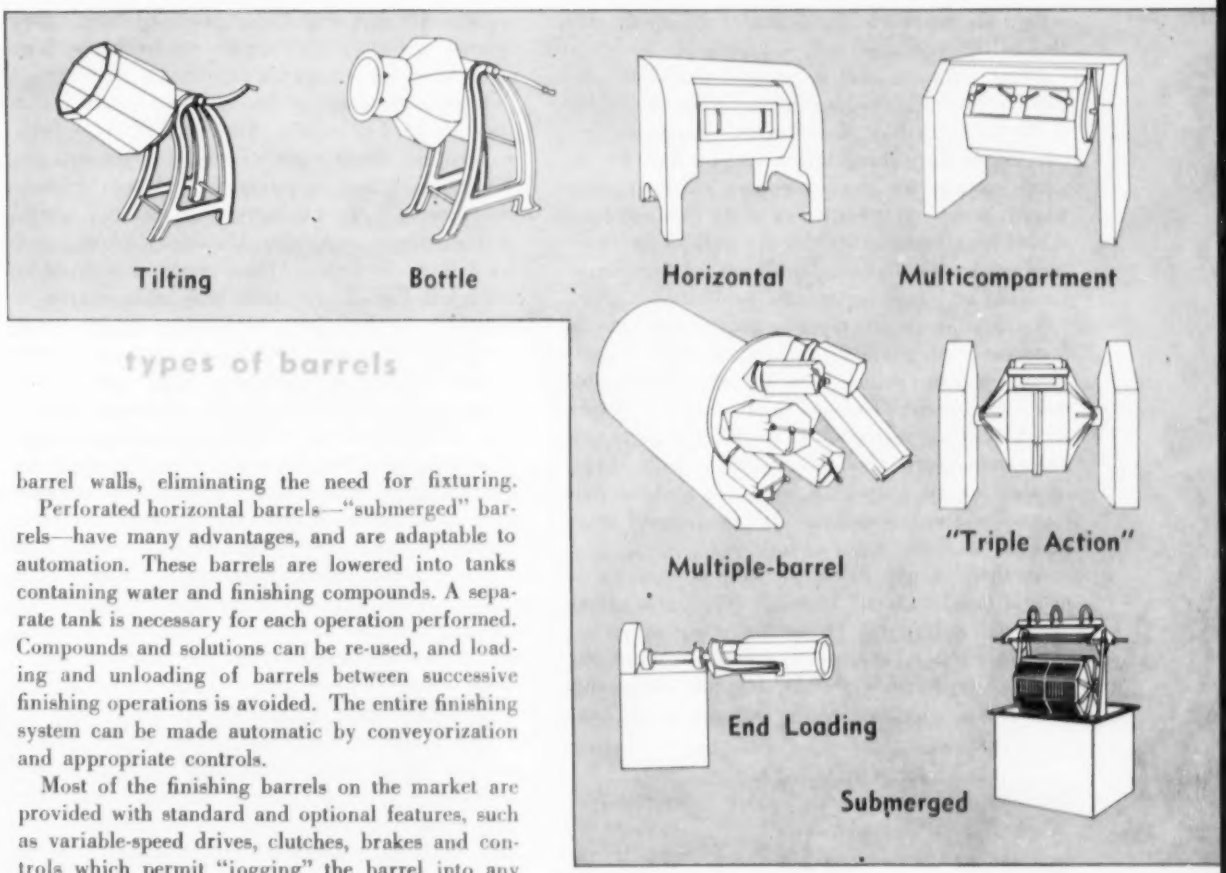
The majority of the barrels in use for precision finishing are of the horizontal type, *Fig.* 4, and are usually hexagonal or octagonal in shape in order to promote the tumbling action. Both ends of such barrels are closed and doors are provided for loading and unloading parts. These doors are normally gasketed and held down with heavy bolts to prevent leakage of liquids during the finishing cycle. Often, the interior of the barrel is divided into several compartments, with individual doors, to permit finishing different parts in the same barrel, or for individual loading of large parts.

A variation of the horizontal-barrel machine is the multiple-barrel machine, in which a number of individual barrels are mounted on a faceplate, usually at an angle. This arrangement results in an end-to-end pattern of agitation and extensive sliding action which is particularly effective for long, narrow parts, in addition to providing the convention horizontal-barrel action.

Another variation of the horizontal barrel is the "triple-action" barrel. The sloping sides of this type of barrel give an additional tumbling action, especially effective with flat parts, which sometimes tend to stick to the straight sides of conventional horizontal barrels. End-loading barrels, another special type, are usually long and narrow. They are particularly adapted to finishing parts which are longer than the diameter of the barrel. Such parts are constrained from twisting by the

Table 1—Barrel Finishing Media

Type	Material	Shape	Size Range (inch)
Balls	polished steel (hardened or unhardened), zinc	ball	0.0937 through 0.625 diam.
Diagonals	polished steel (hardened or unhardened), zinc	cylinder faces parallel but not square with axis	0.0625 through 0.25 diam.
Cones	polished steel (hardened or unhardened), zinc	cone-shaped ends, separated by ring	0.125 through 0.480 height; 0.160 through 0.535 diam.
Ovals	polished steel (hardened or unhardened), zinc	"football" with rounded ends	0.125 through 0.375 diam.
Pins	polished steel (hardened or unhardened), zinc	pin	various lengths
Natural Stones 	granite, gravel, sand, limestone	random	various
Man-Made Stones 	fused aluminum oxide	random	graded from 1.5 - 2 inches long (largest size) to 0.0937 long (smallest size)
Bonded Shapes	abrasive grains bonded in vitrified material or rubber	balls, cylinders, triangles	various
Abrasive Grains	aluminum oxide	random (breaks up during finishing cycle, exposing fresh cutting edges)	coarse mesh to 1000 grit



types of barrels

barrel walls, eliminating the need for fixturing.

Perforated horizontal barrels—"submerged" barrels—have many advantages, and are adaptable to automation. These barrels are lowered into tanks containing water and finishing compounds. A separate tank is necessary for each operation performed. Compounds and solutions can be re-used, and loading and unloading of barrels between successive finishing operations is avoided. The entire finishing system can be made automatic by conveyorization and appropriate controls.

Most of the finishing barrels on the market are provided with standard and optional features, such as variable-speed drives, clutches, brakes and controls which permit "jogging" the barrel into any required position. Barrels which are used for high production should be lined, particularly if they are used for wet finishing, *Fig.* 5. Wood-lined barrels are suitable for finishing plastics. For metal parts, rubber, neoprene and plastisol linings all give satisfactory results in protecting the barrel from the abrasive action of parts and media, and possible corrosion from liquids.

Table 2—Barrel Finishing Compounds

Type	Application
Acid	descaling heat-treated parts
Alkaline	neutralizing acid compounds prevent rusting and preserve color when roughing ferrous metals wash for removing oil
Neutral	cleaning and sudsing agent for all types of finishing
Cutting	mixture contains abrasive grains plus acid, alkaline or neutral compounds. Formulations for all types of finishing are available
Wetting Agents	used to rinse finished parts—promote drying
Flushing Oils	inhibit rust

Types of Media: Media such as metal shapes, natural and artificial stones, shaped abrasive products and electric furnace products considerably extend the range of applications of barrel finishing processes. A list of those media is found in TABLE 1.

Media have a number of purposes. These are:

1. Prevent workpieces from striking against each other during finishing
2. Provide abrasive action
3. Add weight to the load, to expedite abrasive action.
4. Aid in finishing holes, recesses and other hard-to-reach areas
5. Act as burnishing tools
6. Dry parts.

Sawdust and corncob meal, two types of nonabrasive media, are used for drying and polishing parts. Hardened and polished steel media, available in a number of shapes, are used principally for burnishing. Hardened and unhardened steel and zinc media are also used in conjunction with abrasive grains for grinding and similar operations, to give

weight to barrel loads and thus speed up the cutting action.

Metal balls are used to produce a smooth, efficient cutting or burnishing action on flat or curving surfaces or shallow depressions. Diagonals are adapted to burnishing inside corners and angles. Cones are used for grooved sections and long joints where curved and flat surfaces meet. Ball and cone shapes are often used together for workpieces which combine several finishing problems. Also, several sizes can be mixed for specific applications.

Segregating various types or sizes of metal media from each other after a production run is completed requires tedius hand labor. Accordingly, many users prefer "ballcone" and "ovalball" shapes which duplicate the action of mixtures of balls and cones or mixtures of different sizes of balls. Pins, another special shape, are used for probing into crevices and surface etchings, and for recessed areas such as the inner edges of fork tines.

Another important class of media is made up of natural and "artificial" "stones," *Fig.* 6, also called "nuggets" or "chips." The natural stones are available in random shapes in several size ranges. Granite, limestone, gravels and sands are among these media, which are highly satisfactory for general-purpose finishing work, but are neither as abrasive nor as long-lasting as artificial stones.

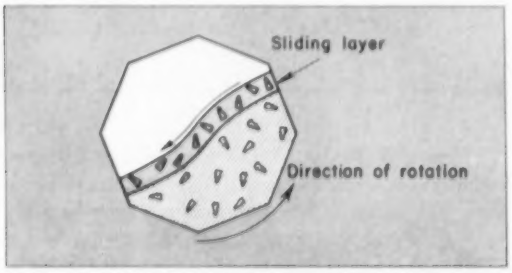


Fig. 3. Most of the work done on parts in a barrel is accomplished in the sliding layer.

Aluminum oxide artificial stones are the most universally used media. They are available in random shapes and in standard sizes ranging downward from a maximum of approximately two inches in length. They have considerable abrasive action, particularly during long finishing cycles. As small particles and grains are worn off, cutting is expedited. In large sizes aluminum oxide stones are suitable for heavy deburring and descaling work and, in smaller sizes, they are used for grinding and improving surface finishes.

Aluminum oxide abrasive grains are available in a wide range of grit sizes, ranging from coarse meshes to 1000 grit. They are used either with or without media to expedite finishing.

One disadvantage of fine abrasive grains is that they are hard to reclaim. After each finishing cycle some of the abrasive grain is lost. To overcome this disadvantage and to minimize wedging problems encountered with random-shaped stones, special bonded media containing aluminum oxide grains have been developed. These media are made in triangles, *Fig.* 7, cylinders and other shapes in closely controlled sizes. Vitrified or rubber bonds are used. In general, hard bonds produce the best surface finishes on workpieces, while softer bonds result in a faster cutting action. Media are available with different grit sizes and bond hardnesses to suit specific requirements. Descaling and deburring cycles with vitrified shapes are extremely fast; in some cases three times faster than with aluminum oxide random shaped media used with abrasive grit. Bonded media can be re-used until they are worn down to the point where lodging or wedging becomes a problem. It will then be necessary to use new media for the job; however, worn-down media can be reclaimed for use on workpieces with smaller holes or crevices.

Many other types of special media are on the market. Wood pegs, for instance, are extensively used for finishing plastics. There are several electric furnace products which give excellent results where high surface finishes are specified. Often considerable ingenuity is exercised by barrel finishing engineers in finding media which will perform satisfactorily in conjunction with a given workpiece. One engineer, for example, found by experiment that common wire nails, available at any hardware store, were the best media for deburring a small gear, using abrasive grains.

Media Selection: Factors governing media selection include size of workpiece, size of holes and other recesses, type of operation to be performed, and surface finish requirements. For deburring, deflashing and removal of loose scale, self-tumbling with abrasive grains may suffice, or natural stones, aluminum oxide stones or abrasive grains may be used. Bonded media give fast cutting action. Aluminum oxide stones provide a faster cutting action than natural stones. Use of water and compounds will accelerate deburring or descaling.

Grinding operations are usually done wet. Again, natural stones or aluminum oxide stones, bonded media or abrasive grains can be used. Unhardened steel or zinc metal shapes, used with abrasive grains, are also applicable.

Polishing is accomplished with fine abrasive grains, often in conjunction with stones or metal media. These give weight to the load and carry abrasive into recessed areas. Polishing is usually a wet operation.

Hardened and polished steel balls or other shapes are usually used for burnishing operations. Roughing can be accomplished by using any abrasive media which will produce the desired matte finish.

When using abrasive media, large stones produce the fastest cutting action and largest radii. However, smaller stones or nuggets produce superior finishes. As a general rule, the media used should be the largest size which will produce an acceptable surface finish.

Media should be either too large to lodge in holes or crevices in the workpiece, or small enough to pass through without the possibility of lodging. If it is necessary to chamfer holes or finish other hard-to-get-at areas in the workpiece, bonded or metal media of appropriate shape and size are recommended.

Photograph courtesy of The Carborundum Co.

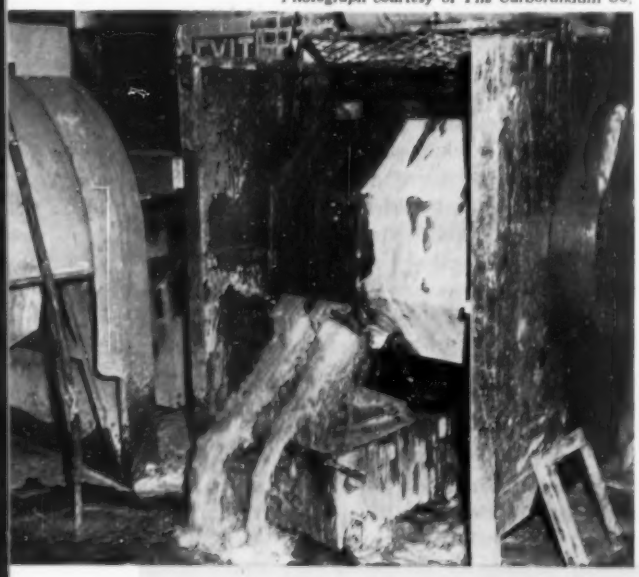


Fig. 4. (above) Horizontal barrel used at Remington Rand, Elmira, N. Y. Perforated doors facilitate drainage; parts and media stay in barrel.

Fig. 5. (right) Typewriter parts being finished in an open-end tilting type barrel at Remington Rand.

Table 3—Relationship of Peripheral and Rotational Speeds for Various Barrel Sizes

(Values in body of table are in rpm)

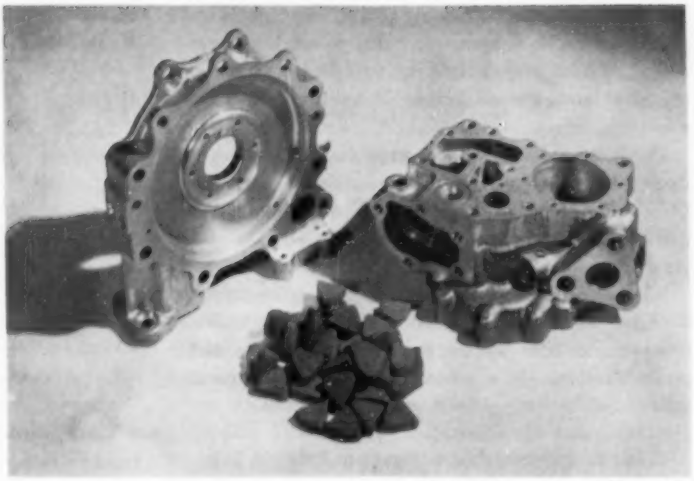
Peripheral Speed (fpm)	Barrel Diameter (inches)									
	40	36	32	30	28	24	20	16	15	12
50	4.8	5.3	6.0	6.4	6.8	8	9.5	12	13	16
60	5.7	6.4	7.2	7.6	8.2	9.5	11.5	14.3	15.3	19
70	6.7	7.4	8.4	8.9	9.5	11	13.3	16.7	17.8	22
80	7.6	8.5	9.5	10.2	10.9	12.7	15.3	19	20	25
100	9.5	10.5	12	12.7	13.6	15.9	19	24	25	32
120	11.4	12.7	14.3	15.2	16.3	19	23	29	31	38
150	14.3	15.9	18	19	20	24	29	36	38	48
180	17	19	21	23	25	29	34	42	46	57
200	19	21	24	25	27	32	38	48	51	64
225	21	24	27	29	31	36	43	54	57	72
250	24	27	30	32	34	40	48	60	64	80

Compounds: As already pointed out, water-soluble compounds are used in conjunction with most precision barrel finishing operations. These may be acid, alkaline or neutral, and usually contain soaps or detergents.

For a compound to meet generally accepted requirements, it must contain a rust preventive, have good suds "life" and "size," be capable of suspending fine particles, contain a water conditioner and have favorable surface-tension qualities. In addition, it should not affect the skin of the operator when normal safety precautions are observed. A list of compounds is contained in TABLE 2.

One purpose of compounds is to keep parts and media clean during the finishing cycle. As the barrel is agitated, small particles are abraded off workpieces and media. If these are not carried away, workpieces and media become covered with a heavy mud or scum which cuts down on the amount of work being performed. The cleansing and lubricating action of the compound prevents this condition.

Photograph courtesy of The Carborundum Co.



Photograph courtesy of Norton Co.

Fig. 7. (right) Intricate parts processed with bonded triangles.

Fig. 6. (below) Refractory media used to deburr and improve surface finish of Hardinge collet pads. Concave area is not affected.

Photograph courtesy of The Carborundum Co.

Small particles abraded from the workpiece or broken from the media are continually removed and carried into suspension in the compound.

An interesting sidelight on the latter phenomenon was disclosed during recent tests in which workpieces were tumbled for long periods of time with aluminum oxide random shapes as media. No abrasive grit was used during the tests. It was found that during the first several hours of finishing, cutting action, as measured by the formation of radii on the corners of workpieces, was slow. With longer finishing cycles, the cutting action increased rapidly. This increase was attributable solely to action of small particles of aluminum oxide which were broken off the stones. Carried into suspension in the compound, these particles did an increasingly effective cutting job.

Acid type compounds (pH 1 to 6) are used primarily for descaling parts that have been heat-treated. Parts should not be allowed to remain in the acid solution after completion of the cycle, since acids have a definite tendency to etch workpieces. Prompt neutralization of the acid compound with an alkaline compound (pH 8 to 14) is essential, and this neutralization should be followed by washing the parts with water containing a rust inhibitor.

Alkaline compounds are used in roughing operations on ferrous metals to prevent rusting and to maintain the natural color of the metal. They are also used as a wash for removing oil or for brightening parts prior to a finishing operation. Alkaline compounds should never be used with nonferrous metals unless they are of types formulated specifically for the workpiece material involved because an alkaline "burn," taking the form of a black coating or a grease-like film may result.

Acid compounds must be used with caution, particularly during neutralization, to prevent possible injury to personnel or damage to parts. During neutralization, gases are generated. Some barrels are built with a "safety-valve" feature which allows gases to escape before pressures are built up to dangerous levels.

For general-purpose work, neutral compounds give highly satisfactory results, and they require no special handling or safety precautions. They can be used with metals, plastics and rubbers without harmful attack, and with all types of media.

Many proprietary compounds contain abrasives as well as soaps or detergents, water softeners and rust inhibitors. These "cutting" compounds are available with various abrasive grain sizes, and are formulated specifically for deburring, descaling, improving surface finish and similar operations. Once a satisfactory cutting compound has been found for a specific job, uniform results can be achieved by always using the same compound and the same proportions of water, media and parts. Every effort should be made to prevent operators from deviating from the established compound-

water-media-parts ratio. Often, operators will attempt to increase the speed of the finishing cycle by adding additional cutting compound. While this does increase the amount of abrasive in the mix, it also increases the amount of detergent. An excessive amount of detergent can produce overheavy suds and a thick "soup" which actually inhibits the cutting action of the abrasive.

In one case where aluminum parts were being deburred and it was necessary to decrease the finishing cycle to meet urgent production requirements, an operator, acting on the theory that "if a little bit is good, more is better," actually added so much detergent cutting compound that the parts floated on the surface of the solution. As a result, no work was accomplished on the parts during the finishing cycle.

After completing of barrel finishing cycles and rinsing of parts with water, they can be air-dried after unloading. When it is not possible to dry ferrous parts immediately, they should be rinsed with a protective oil to provide short-term protection against rusting in transit or in storage. "Slushing" oils are suitable for this purpose. They form a film approximately 0.0002 inch thick on the surfaces of parts, giving adequate protection. In addition to oils, many other excellent rust-retarding compounds are available.

Water Hardness: Considerable care is exercised in the selection of compounds and equal attention should be paid to the water with which compounds are mixed. Hard water sometimes causes pitting, staining or rusting of parts, so it is advisable to have the water used for barrel finishing operations tested. If necessary, a water conditioner can be added to the water in the barrel prior to tumbling. When compounds containing water softeners are used, they should be balanced to the chemical content of the local water supply.

Water Level: Although wet finishing operations have been common for many years, there is still some disagreement as to the best level of water in the barrel for specific types of work. All authorities agree, however, that water exerts a cushioning effect on media and workpieces. Thus maximum cutting is accomplished with low water levels, while best surface finishes are obtained with high water levels. Determining the best water level for a given application is largely a matter of experiment.

Starting with a water level even with the top of the mixture of media and workpieces, it can be lowered or raised for successive batches of work until a satisfactory balance between speed of cutting and surface finish is found. For most applications, this level will be between four inches below and four inches above the level of the media-workpiece mixture, using a 30-inch diameter barrel. For fragile parts, where maximum cushioning effect is desired, the level may be considerably higher than four inches above the workpiece-media mixture; for operations where maximum cutting action is the primary consideration, extremely low water levels may give best results.

Ratio of Parts to Media: The proportion of workpieces to media may be as low as 1:6 or as high as 1:2. Measurements are made by volume. Workpiece-media proportions depend on the contours, size and weight of the workpiece. A high proportion of media gives maximum protection against workpieces striking against each other and nicking; on the other hand, it cuts down on the number of pieces produced during each cycle. When working with aluminum oxide stones, *Fig.* 5, the normal ration of workpieces to stones is 1:3. Where a less exacting finish is acceptable, a 1:2 ratio can be used, and even 1:1 ratios are sometimes practicable. If close tolerances and fine finishes are required or it is necessary to remove recessed burrs, ratios up to 1:6 may be necessary.

Data courtesy of Almco Div. of Queen Stove Works

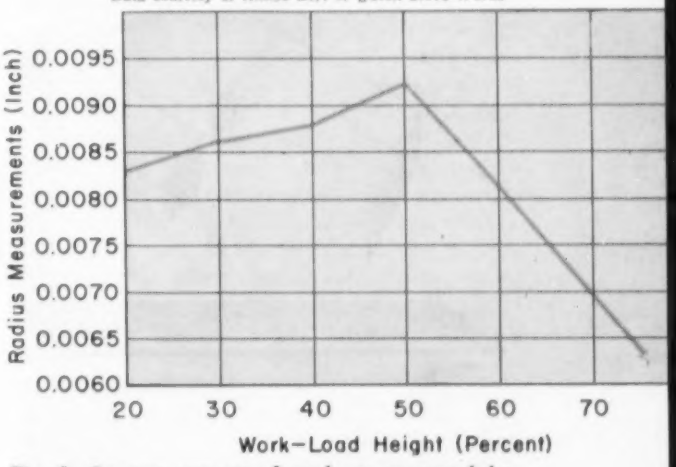


Fig. 8. Greatest amount of work, as measured by generation of radii, is done with a barrel 50 percent full.

Work-Load Height: As already pointed out, most of the work in a horizontal barrel is accomplished by a sliding action. For best efficiency, the sliding layer should be as long as possible. Thus

it is evident that loading a horizontal barrel to 50 percent capacity will produce the maximum abrading action. This has been proved experimentally by engineers at the Almco Div. of Queen Stove Works, Inc. In six tests, an equal number of hardened steel parts were processed in the same manner except that larger amounts of abrasive media were added to raise the work load height. The results are indicated in *Fig.* 8.

Barrel Speed: It might be expected that high rotational speeds would increase the amount of abrading or cutting action in a barrel. However, as rotational speeds increase, the height of the turnover point, the point at which the sliding action of the work load starts, also increases. When the turnover point reaches a certain height, the sliding action is lost. Instead, the parts fall, rather than slide, a condition known as "throwing." This cuts down on abrading efficiency and may result in damage to parts by nicking or part-on-part impingement. For this reason, speeds should be low when running heavy parts.

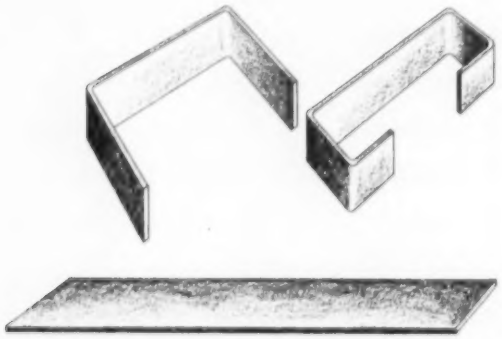


Fig. 9. Burr removal is fastest on flat strip; slowest on C-shaped part.

Because of the variation in the size, weight and configuration of parts, no specific recommendations can be made as to barrel speeds. Most barrel speeds are in the range from 6 to 30 rpm. Small barrels are run at speeds as high as 35 rpm. Ferrous parts are processed at higher speeds than aluminum, copper, brass, magnesium and soft-alloy parts. Some users prefer to specifiy barrel speeds in feet per minute. Rpm values can be converted to fpm by using the data in TABLE 3.

Time Cycles: The amount of time required for a barrel-finishing operation is dependent on the type of work done and the configuration of the workpieces. The type of media and compounds, water level, ratio of parts to media, work-load height and rotational speeds also affect the duration of the barrel-finishing cycle. Time cycles for the majority of operations range from one to six hours.

The influence of workpiece configuration on barrel-finishing time cycles was illustrated by Almco engineers in a series of tests on steel strips, *Fig.* 9. These were cut by a punch press, leaving normal burrs. One-third of the strips were left flat; one-third were formed into a U-shape; and one-third were formed into a C-shape. All parts were deburred in a barrel under the same operating conditions. Burrs were completely removed from the flat pieces in 45 minutes, as compared to two hours for the U-shaped pieces and eight hours for the C-shaped pieces.

The condition of workpieces often affects the length of barrel finishing cycles. On small stampings, for instance, the amount of burr depends, to a large extent, on the sharpness of the punch used to blank or pierce the part. With extremely dull punches, the metal may actually be extruded around the edges of holes. Removal of this extruded metal is not, properly speaking, a barrel-finishing operation. If barrel finishing is attempted, the amount of time required to remove the extruded metal will be excessive and excessive radii may be generated on other areas of the workpiece.

Similarly, while barrel finishing is used to remove marks left by machining operations, a barrel-finishing department should not be made responsible for removing machine marks resulting from dull tools or poor machine condition. In short, barrel finishing is not a substitute for adequate tool, die or machine maintenance; properly applied, however, barrel finishing methods are an effective tool for cost reduction.

Acknowledgments

The assistance of the following individuals and companies is herewith gratefully noted:

The Abbott Ball Co.....Hartford, Conn.
Almco Div. of Queen Stove Works, Inc...Albert Lea, Minn.
BMT Mfg. Corp.....Elmira Heights, N. Y.
Globe Barrel Finishing Equipment Div. of
Casalbi Co.....Jackson, Mich.
Lord Chemical Corp.....York, Pa.
Norton Co.....Worcester, Mass.
Tumb-L-Matic, Inc.....New York, N. Y.
Westinghouse Electric Corp.....Pittsburgh, Pa.
The Carborundum Co.....Niagara Falls, N . Y.

Special thanks are due Mr. R. C. Trow of Almco Div., Messrs. Donald A. Mosher and Frank Soper of BMT Mfg. Corp., Mr. R. W. Fitch of The Carborundum Co., Mr. William B. Sparks of Casalbi Co., Mr. E. L. Gustafson of Norton Co., and Mr. Ralph Envedy of Westinghouse Electric Corp. All of these individuals took time from their regular duties to discuss barrel finishing with the author, either in person or by correspondence. Mr. Charles Benjamin, Finger Lakes Chemical Co., also deserves mention for his research in connection with finishing compounds.

safe operation of abrasive wheels

STRENGTH OF ABRASIVE wheels is always limited by the type of operation they are intended to perform. As the outer abrasive layer in a wheel becomes dull from grinding, the dull grains break free, exposing new cutting edges. This action is progressive and continuous. Wheels having greater strength than required by the stresses set up on any specific grinding operation will not grind properly for they will not release the dull grains. Strength limitations of abrasive wheels are, however, no handicap to their safe operation, as has been amply demonstrated by the excellent safety record in the field of grinding. When effective safety devices are utilized and sound operating procedures are observed, the potential hazards of grinding operations are minimized, if not prevented entirely.

Handling and Storage: Care must be exercised in handling of abrasive wheels; careless handling can lead to cracks or other damage which might cause a wheel to break in service. The factors influencing wheel strength are:

BOND: In general, inorganic (vitrified, silicate and magnesite) bonds are more brittle than organic (resinoid, shellac and rubber) bonds. Hence inorganic bonds can be broken more readily by handling, shock or impact.

GRAIN SIZE: Wheels containing fine abrasives are normally stronger than wheels of the same grade and bond containing coarser abrasives.

GRADE: Hard grade wheels are stronger than softer wheels of the same grain and bond.

DIMENSIONS: Wheel strength is reduced as hole diameter is increased. This applies to wheels of any thickness.

Obviously, abrasive wheels should not be dropped or bumped during handling. Large wheels should be carried, not rolled, from place to place. Trucks or suitable conveyors which provide proper support should be used for transportation of wheels which are too large to carry by hand.

All grinding wheels should be stored in dry rooms which are not subjected to extreme temperature changes. Thin organic-bonded wheels should be stored flat on a perfectly flat horizontal surface. Most straight or tapered wheels of appreciable thickness are best supported on edge in racks. Such racks should provide two-point cradle support to prevent rolling and should have partitions to allow handling of individual wheels without the possibility of tipping other wheels over. Certain strong wheels are sometimes stacked in piles. Height of the piles should not exceed three feet. Cylinder wheels and large straight cup wheels may be stacked on flat sides with corrugated paper or some other cushioning material between them, or they may be stored on edge in racks similar to those used for large straight wheels. Small wheels can be conveniently stored in boxes or drawers.

Inspection: When received, abrasive wheels should be inspected by using the "ring" test. Light wheels are suspended for testing by inserting a pin through the hole; heavy wheels can be tested while standing on a clean, hard floor. In testing, wheels are tapped gently with a wooden screwdriver handle

---

Extracted from American Standard Safety Code for the Use, Care and Protection of Abrasive Wheels (ASA B7.1-1956). Individuals who are responsible for the safety of grinding operations are advised to obtain copies of the complete code, available free of charge from Grinding Wheel Institute, 2130 Keith Bldg., Cleveland 15, Ohio.

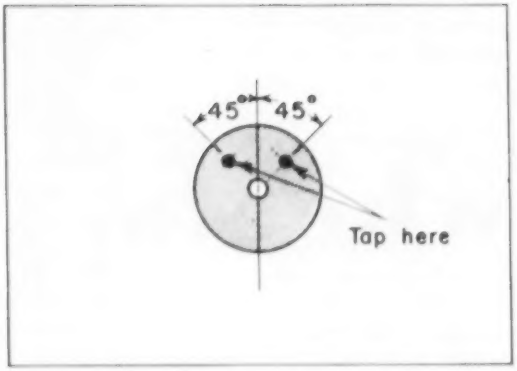


Fig. 1. When tapped at points indicated, a crack-free wheel will emit a characteristic ringing sound.

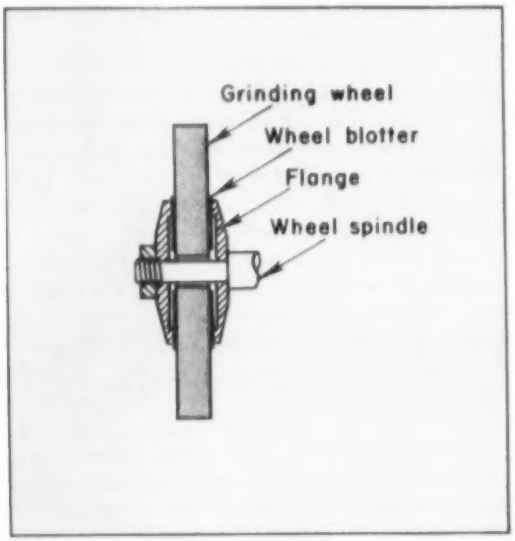


Fig. 2. Correctly mounted wheel, using straight flanges.

at the point indicated in *Fig.* 1. The wheel is then rotated about 45 degrees and the test is repeated. A sound and undamaged wheel will give a clear metallic tone when tapped. Cracked wheels will give a "dead" sound and not a clear "ring."

Flanges: Two major types of stresses are produced in wheels during grinding; those resulting from wheel rotation and those caused by heat generated during grinding. The material closest to the hole is under greatest stress. It is, therefore, important that other stresses developed through mounting (compressive stress) and driving (torque stress) be applied to the wheel as far from the hole as practicable. This can best be accomplished by using flanges, *Fig.* 2, which should not be smaller in diameter than one-third the diameter of the wheel.

Straight flanges, *Fig.* 3, may be either simple inserts of the "collar" type, or may be integral parts of wheel sleeves or adapters. They should be used only where some form of protective device, such as a safety guard, is employed. Safety flanges, *Fig.* 4, can be used where no other standard protective device is employed. They should be used only with wheels specifically designed to fit them. Safety flanges are usually of the tapered type. Wheels used with tapered safety flanges should be tapered at least 0.75 inch per foot on each side.

All safety flanges over 10 inches in diameter should be made of steel. All other flanges can be made from cast iron, steel or other materials having equal or greater strength and rigidity.

Both flanges used to mount a wheel should be of the same diameter, and should be finished all over, correct as to dimensions and in good balance. Straight and tapered flanges should be recessed at least one-sixteenth of an inch on the side next to the wheel. Straight flanges of the adapter and sleeve types should be recessed so that there will be no bearing on the sides of the wheel within one-eighth inch of the hole. Minimum dimensions for a common type of straight flange are shown in TABLE 1. Minimum dimensions for two types of tapered safety flanges are shown in TABLE 2.

Mounting: As already pointed out, improper wheel mounting may produce undesirable stresses in a wheel. Grinding wheels should fit freely on spindles; if it is necessary to force them on they may break. In addition, the possibility of expansion of the spindle due to the heat of an operation should be considered. Loose-fitting wheels should be avoided, however. Washers or flange facings made of compressible material should be fitted between the flanges and the wheel. The maximum recommended thickness of blotting paper is 0.025 inch; maximum thickness of other washer materials is 0.125 inch. The diameter of a washer should be at least as large as the diameter of the flanges.

Care should be exercised in tightening the spindle end nut; it should be tightened only enough to hold the wheel firmly. Excessive clamping strains will damage the wheel.

Operating Speeds: A wheel should never be run at greater speed than the maximum operating

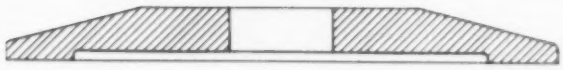


Fig. 3. Straight flange for use with wheels having small holes.

speed established by the manufacturer. Maximum safe speeds for various unmounted types of wheels are shown in TABLE 3. These speeds should not be confused with recommended grinding speeds for specific types of operations.

Maximum safe speeds for mounted wheels (wheels which are cemented onto a mandrel or quill) are shown in TABLE 4.

General Operating Rules: In addition to observing maximum safe speeds, there are a number of other rules which, if observed, will greatly improve the safety of grinding operations and minimize the possibility of wheel breakage.

1. Whenever a wheel is broken, a careful inspection should be made to make sure that the safety guard has not been damaged nor the flanges bent or sprung out of true or out of balance. The spindle and nuts should also be carefully inspected.
2. After mounting a new wheel, care should be taken to see that the safety guard is properly replaced before starting the wheel.
3. All new wheels should be run at full operating speed with safety guard in place for at least one minute before applying work, during which time the operator should stand at one side.
4. Work should not be forced against a cold wheel, but applied gradually, giving the wheel an opportunity to warm.
5. Wheels should be rebalanced when necessary. If they are so badly unbalanced that they cannot be balanced by truing or dressing, they should be discarded.
6. Wheels used in wet grinding should not be allowed to stand half-immersed in coolant. This may throw the wheel dangerously out of balance.
7. Grinding on the flat sides of straight wheels is often hazardous and should not be allowed when it causes the sides of the wheel to become appreciably worn or when it is necessary to bring any considerable or sudden pressure to bear against the sides.
8. Wheel dressers should be equipped with safety guards.

Table 1—Minimum Dimensions for Straight Flanges (inches)

Wheel Diam	Minimum OD of Flanges	Radial Width of Flange Bearing Surface Minimum-Maximum	Minimum Thickness of Flange at Bore	Minimum Thickness of Flange at Edge
1	0.375	0.0625—0.125	0.0625	0.0625
2	0.75	0.125 —0.1875	0.125	0.0937
3	1.0	0.125 —0.25	0.1875	0.0937
4	1.25	0.1875—0.375	0.1875	0.125
5	1.5	0.1875—0.375	0.25	0.125
6	2.0	0.25 —0.50	0.375	0.1875
7	2.5	0.25 —0.50	0.375	0.1875
8	3.0	0.25 —0.50	0.375	0.1875
10	3.5	0.3125—0.625	0.375	0.25
12	4.0	0.3125—0.625	0.50	0.3125
14	4.5	0.375 —0.75	0.50	0.3125
16	5.5	0.50 —1.0	0.50	0.3125
18	6.0	0.50 —1.0	0.625	0.375
20	7.0	0.625 —1.25	0.625	0.375
22	7.5	0.625 —1.25	0.625	0.4375
24	8.0	0.75 —1.25	0.625	0.4375
26	8.5	0.75 —1.25	0.625	0.50
28	10	0.875 —1.50	0.75	0.50
30	10	0.875 —1.50	0.75	0.625
36	12	1.0 —2.0	0.875	0.75
42	14	1.0 —2.0	0.875	0.75
48	16	1.25 —2.0	1.125	1.0
60	20	1.25 —2.0	1.25	1.125

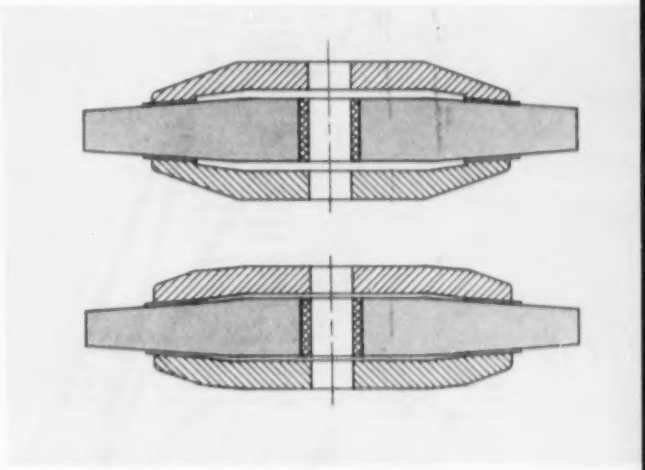


Fig. 4. Two designs for tapered safety flanges for use when speeds are under 6500 fpm.

Table 2—Minimum Dimensions for Tapered Safety Flanges (inches)

(Wheel Speeds Less Than 6500 fpm)

Wheel Diam	Minimum OD of Flanges	Minimum Thickness of Flange at Bore	Maximum Flat Area at Center of Flange (inside)	Maximum Diam of Flat Area on Side of Wheel
6	3	0.375	0	1
8	4	0.375	0	1
10	5	0.50	0	2
12	6	0.625	4	4.5
14	8	0.625	4	4.5
16	10	0.625	4	6
18	12	0.75	4	6
20	14	0.75	4	6
22	16	0.75	4	6
24	18	0.75	4	6
26	20	0.75	4	6
28	22	0.875	4	6
30	24	0.875	4	6
36	28	1.0	4	6

Table 3—Maximum Speeds for Unmounted Wheels

Classification Number	Type Number	Wheel Design	Vitrified and Silicate Bonds			Organic Bonds		
			Strength			Strength		
			Low	Medium	High	Low	Medium	High
			Wheel Speed (fpm)					
	1	Straight wheels (except classification 7)	5,500	6,000	6,500	6,500	8,000	9,500
	4	Taper wheels	5,500	6,000	6,500	6,500	8,000	9,500
1	5, 7	Recessed wheels	5,500	6,000	6,500	6,500	8,000	9,500
	12	Dish wheels	5,500	6,000	6,500	6,500	8,000	9,500
	13	Saucer wheels	5,500	6,000	6,500	6,500	8,000	9,500
2	2	Cylinder wheels	4,500	5,500	6,000	5,000	6,000	7,000
		Dovetail wheels	4,500	5,500	6,000	6,000	8,000	9,500
3	11	Flaring cup wheels	4,500	5,500	6,000	6,000	8,000	9,500
4	6	Cup wheels	4,500	5,000	5,500	6,000	8,000	9,500
5		Abrasive disks (plate-mounted, inserted-nut and projecting-stud)	5,500	6,000	6,500	5,500	7,000	8,500
6		Cylinder type abrasive disks (plate-mounted, inserted-nut and projecting stud	4,500	5,500	6,000	5,000	6,000	7,000
7	1	Reinforced wheels (diam 10 inches or less; one-half inch thick or less, with exception of cutting-off wheels) *	—	—	—	9,500	12,000	14,200
8	27	Depressed-center reinforced wheels	—	—	—	9,500	12,000	14,200
9		Diamond cutting wheels (a) Metal-bonded with steel center	—	—	—	—	—	14,000
		(b) Metal-bonded with metallic compound center	—	—	—	—	—	7,500
		(c) Resin-bonded with resin or metallic compound center	—	—	—	—	—	7,500
		All other types of diamond wheels	—	—	—	—	—	6,500

* Speeds for cutting-off wheels with high-strength organic bonds are 7,500 to 14,000 fpm for wheels larger than 16 inch diam; 10,000 to 16,000 fpm for 16 inch and smaller diam wheels. The upper limits are also applicable to reinforced high-strength organic-bond cutting-off wheels.

Table 4—Maximum Operating Speeds for Mounted Wheels

Outside Diameter of Wheel (inches)	Maximum Speed (fpm)
0.25	152,800
0.3125	122,200
0.375	101,900
0.4375	87,310
0.5	76,390
0.625	61,120
0.6875	55,560
0.75	50,930
0.8125	47,010
0.875	43,650
0.9375	40,740
1.0	38,200
1.125	33,950
1.25	30,560
1.375	27,780
1.5	25,470
1.625	23,520
1.75	21,830
2.0	19,100

REFERENCE SHEETS

9. The space around a machine used for grinding should be kept dry and as free as possible from obstructions.
10. Machine spindle bearings should be kept properly lubricated to prevent heating which might cause damage to the wheel.
11. All arbors, adapters or other machine parts on which wheels fit should be periodically checked and maintained to size.
12. Work rests for offhand grinding should be kept adjusted close to the wheel with a maximum distance of one-eighth inch to prevent the work from being caught between the wheel and the rest. The work rest should be securely clamped after each adjustment and the adjustment should not be made while the wheel is in motion.
13. All abrasive wheels, with the exception of wheels smaller than two inches in diameter or wheels used for internal work where the workpiece affords protection, should be equipped with a safety guard.

A final rule for grinding safety is to make sure that only competent persons are assigned to the mounting, care and inspection of grinding wheels and machines. Careful training of such individuals will pay off in terms of safer working conditions.

News

APRIL 1957

featured this month

ASTE Honor Awards 125
1957-58 Chapter Officers 132
Houston Dispatch 135
1957 Annual Report 137
April On-Campus Conferences 146
Chapter News and Views 147

chapter news

Battle Creek 147
Benton Harbor-St. Joseph 150
Binghamton 150
Buffalo-Niagara 153
California State Polytech. 148
Canton 150
Chicago 150
Dayton 150, 153
Elmira 153
Erie 150
Fairfield County 147
Fort Wayne 150
Fox River Valley 150
Golden Gate 150
Grand River Valley 150
Granite State 147
Hamilton District 150
Houston 150
Indianapolis 150
Kalamazoo 150
Lansing 148
Lehigh Valley 150
Lima 152
Little Rhody 150, 152
Long Beach 150
Long Island 148
Lorain County 153
Los Angeles 148
Macomb 149
Mansfield 150
Mid-Hudson 148, 150
Milwaukee 150
Mississippi 150
Mohawk Valley 150
Monadnock 151
Montreal 151
Nebraska 151
New Haven 151
Niagara District 149, 151
North Texas 151
Northwestern Pennsylvania 151
Oklahoma City 152
Ottawa Valley 151
Philadelphia 152
Phoenix 152
Portland, Me. 152
Portland, Ore. 152
Purdue University 147
Racine 149
Riverside 152
Rockford 151
Saginaw Valley 153
St. Louis 147, 149
San Antonio 153
San Fernando Valley 152
Santa Ana Valley 152
Santa Clara Valley 147
Schenectady 153
Schuylkill Valley 152
Springfield, Mass. 147, 152
Springfield, Ohio 152
Syracuse 149, 152
Toledo 152
Toronto 149
Tri-Cities 152
Twin States 152
Wichita 148, 152
Williamsport 152
Windsor 152
Worcester 152

HONOR AWARDS

Signal honor was accorded six men for their outstanding achievements in the field of tool engineering, at a special banquet held March 23, at the Silver Anniversary Meeting in Houston. Recipients of ASTE's National Honor Awards for 1957 were presented with the gold medal plaques and individual citations by Howard C. McMillen, retiring president of the Society.

This year two new awards, the ASTE Education Award and the ASTE Research Medal, took their places with the four original ones, inaugurated at the annual membership meeting of 1955, and set up as an annual tribute to leaders of the engineering profession.

The six honor awards and their recipients are:

ASTE Education Award, for developing dynamic curricula, fostering sound training methods, or inspiring students to enter the profession of tool engineering, awarded to Professor Frederick Preator, head of the Tool Engineering Department, Utah State Agricultural College.

ASTE Research Medal, for significant published research, leading to a better understanding of materials, facilities, principles, and operations, and their application to better manufacturing, awarded to Hans Ernst, director of research, Cincinnati Milling Machine Co.

ASTE Gold Medal, for outstanding service through published literature, technical writings, or papers dealing with tool engineering, awarded to Dr. Earle Buckingham, technical director, Geartronics, Inc.

ASTE Engineering Citation, for unusual skill in the development of tool engineering principles, design or practices, to Louis F. Polk, president, The Sheffield Corp, and vice president, the Bendix Aviation Corp.

Joseph A. Siegel Memorial Award, perpetuated by past presidents in memory of the first ASTE president, for contributions through leadership, voluntary support, or timely acts of benefit to the Society, to Frank A. Shuler, ASTE past president.

ASTE Progress Award, for accomplishments in the field of manufacturing processes, methods, or management, to Harry F. Vickers, president, Sperry Rand Corp.

The ASTE Honor Awards Committee, which made the selections, consists of nine members, all of whom are past presidents of the Society. This year's committee is headed by James R. Weaver, chairman, and Frank W. Curtis, vice chairman. Other committee members are C. V. Briner, D. D. Burnside, A. H. d'Arcambal, I. W. Holland, R. H. Morris, A. M. Sargent, and O. W. Winter.

The awards consist of two parts: a wall plaque displaying a gold medallion, especially designed for each award, together with a metal plate for the recipient's name; and a framed engraved citation.

Honored educator of realistic, practical vision . . . thorough builder of tool engineering curricula, and acknowledged prime mover in securing establishment of the first regular degree diploma of Bachelor of Science in Tool Engineering . . . beloved of many students whom he has well equipped for professional responsibility.

ASTE EDUCATION AWARD

**presented to Frederick Preator,
head of the department of tool engineering,
Utah State Agricultural College**

Professor Preator, who was extremely instrumental in the establishment of a tool-engineering curriculum on the Utah State Agricultural campus, the first college to offer a degree in such a course, has in many other ways been outstanding in his promotion of tool engineering.

After graduating from Birmingham Technical School in his native England, he served in Great Britain's Royal Air Force in World War I, later coming to the United States. While teaching at Logan High School, he attended Utah State Agricultural College, from which he graduated in 1935. He began teaching there as instructor of metals in 1937, and has been with the college almost continuously since then, receiving his full professorship in 1947. During World War II he worked as tool-design engineer for several companies in the national defense effort.

Professor Preator has been extremely active in ASTE affairs, serving on both chapter and national committees, including the National Education Committee in particular. He has represented the Society on the Utah Engineering Council, and has written articles for several education journals, as well as for THE TOOL ENGINEER. He was the principal author of ASTE's 10-page brochure on Professional Careers for Tool Engineers.

Recognized internationally for basic research investigation and findings in the science of metal-cutting, and developer of machines and methods to facilitate that science . . . consistent proponent of practicability in applying machining principles . . . honored collaborator in advancing professional ethics and practices.

ASTE RESEARCH MEDAL

presented to Hans Ernst
director of research,
Cincinnati Milling Machine Co.

Hans Ernst has been in charge of research at the Cincinnati Milling Machine Co. for the past 28 years. He came to the company in 1926, joining the engineering staff and organizing the research department. His first job, the development of a hydraulic feed for a milling machine, resulted in the Hydromatic machine. Thousands of these machines have been made for the production of metallic parts of all sorts. Today's Hydromatic machines are basically unchanged in design after 27 years, a tribute to his engineering foresight.

Mr. Ernst is recognized internationally as an authority on metal-cutting. His paper, "Physics of Metal-Cutting," is regarded as the bible of this field. In addition, over 100 patents, covering such things as automatic hydraulic cycles for grinding machines, unusual valves, and hydraulic and electric circuits, have been issued in his name.

Born and educated in Australia, he came to this continent during the first World War, in time to serve one year in the Canadian Royal Air Force. He broke his first professional affiliation, with Western Cartridge Co., because his nature rebelled at producing anything destructive. His love of fellow men has made him an ideal of professional integrity and dedication, a giant among men and a genius among engineers.

World authority upon gear design and application . . . author of major reference books, and innumerable significant reports and articles upon gearing, machine design, and interchangeable manufacturing . . . wise and kindly teacher of several generations . . . selfless servant to the engineering profession.

ASTE GOLD MEDAL AWARD

presented to Earle Buckingham
technical director,
Geartronics, Inc.

Dr. Earle Buckingham who, until his recent retirement, was professor of mechanical engineering at Massachusetts Institute of Technology, is widely known as an outstanding authority on gears and their applications, and as an inexhaustible contributor to engineering literature. He has authored six books and innumerable technical papers and articles, commencing in 1911 and continuing to the present time. His group of books on gear design, production and application are considered outstanding in the field of mechanical engineering. In 1950 he was honored with the Edward P. Connell Award of the American Gear Manufacturers Association for his work as an author and a teacher in his field.

He has contributed to the design and development of a variety of equipment. His work on gears has covered those used for all purposes, and ranging in size from 0.041 inch in diameter to 40 feet in diameter. Dr. Buckingham has also done a great deal of work in the field of standardization, and has served for many years on various standards committees of the ASME.

Dr. Buckingham signally served ASTE by his authorship of the "Gears" section of the Tool Engineers Handbook, and is currently assisting in its revision for the second edition.

Dedicated leader in advancement of ultraprecision dimensional measurement and control . . . benefactor to Industry in helping to maintain uniform standards and assure interchangeability of parts in mass production . . . unstinting giver of time and talent in fostering professional goals and the public welfare.

ASTE ENGINEERING CITATION

presented to Louis F. Polk
president, The Sheffield Corp. and
vice president of Bendix Aviation Corp.

A tireless promoter of industrial standards, Louis Polk has been a 20th-century crusader for the acceptance and application of precision measurement and inspection techniques. The Sheffield Corporation, of which he is president, is a leading producer of scientific measuring instruments, gages, automatic gaging machines, and other machine tools essential to the maintenance of uniform standards and interchangeability of parts.

Mr. Polk is the author of several books on metrology and dimensional control, and holds numerous patents covering a wide range of products, including gages, precision instruments and machine tools. He is a frequent speaker before industrial, ordnance, scientific and banking groups.

Holding important positions in many financial and industrial organizations, Mr. Polk served as civilian consultant to the Chief of Ordnance of the Army for several years, ending in 1949. Among his present responsibilities are chairmanship of The Sheffield Corp. of Australia, Pty. Ltd., and of the board of directors of the State Fidelity Federal Savings and Loan Association of Dayton. He is an acknowledged leader in the many professional and civic organizations to which he belongs. Among these are the ASTE, on whose Research Fund Committee he is a permanent director.

THE JOSEPH A. SEIGEL MEMORIAL AWARD
FOR LEADERSHIP of TIMELY BENEFIT to the SOCIETY
FIRST PRESIDENT 1932
ASTE
AMERICAN SOCIETY OF TOOL ENGINEERS

Honored Past President of the Society, prominent in its founding activities . . . his sound administrative planning in the early days was indispensable in structuring the Society into a vital organism . . . a production executive whose achievements contributed largely to mass automotive manufacture.

Joseph A. Seigel Memorial Award

presented to Frank A. Shuler
ASTE past president

Frank A. Shuler, member of the American Society of Tool Engineers since the first year of its existence, headed the organization in 1937-38, the fifth and one of the most crucial years in its history. It was during his presidency that ASTE gained national recognition through the staging of its first machine tool exhibition in 1938, held in conjunction with its annual membership meeting of that year. Due in great measure to Mr. Shuler's efforts and executive planning, the show was a great financial success, and became the forerunner of more and larger shows.

In 1953, he was awarded a certificate of service for his work with the National Production Authority. The certificate was presented " . . . in appreciation of service rendered to the United States Government in time of national emergency, and in official recognition of the outstanding experience and ability for which he was selected to serve . . . " His assignment with NPA involved touring the nation to make progress reports for plants with government contracts.

Mr. Shuler was associated with Chrysler Corp. for nearly twenty years as master mechanic of the Highland Park plant. Prior to this, he owned and operated the Shuler Axle Co.

Renowned for the development of hydraulic principles and their far-reaching application in the driving and control of self-powered vehicles and machine tools . . . able executive whose vision, ingenuity, and drive have heavily contributed to the national defense and the public welfare.

ASTE Progress Award

presented to Harry F. Vickers
president, Sperry Rand Corp.

Harry Vickers, head of Sperry Rand Corp. and its 85,000 employees, began his amazing career with only a deep interest in hydraulic machinery. Through tutoring and correspondence courses he gained the technical training needed to design these machines, and in 1921 he formed a company in Los Angeles to build them. His designs and inventions led him to the principle of power steering, which he brought to Detroit as early as 1930.

Finding the automotive industry reluctant to adopt power steering during the depression, he joined with Fred Fisher to form Vickers, Inc., and turned to machine tool and military applications of hydraulics. Some of his designs contributed largely to the effectiveness of the U. S. Navy during the second World War. Following a merger of his company with Sperry Corp., he ultimately became its president. In 1955 the Sperry Corp. merged with Remington Rand to form the Sperry Rand Corp., of which Mr. Vickers is now president.

After the war he realized an early ambition to be a pilot, and now flies a DC 3 regularly. He received a Doctor of Science degree from the University of Southern California in 1956. Holder of the ASME medal, he belongs to many naval, aeronautical and engineering organizations.

Pictured at Chicago chapter are, from left: Harry Egan, newly elected chairman; E. J. Krabacher, speaker, whose subject was "Progress in Metal-Cutting and Grinding Research"; Joseph Kosinski, program chairman; and R. W. Miller, outgoing chairman.

Student officers at Peoria are, seated from left: John Abraham, chairman and W. Logue, adviser. Standing are: Bill Smith, vice chairman; Jim Fredell, secretary; and Ken Bledsoe, treasurer.

1957-1958
CHAPTER OFFICERS

Peoria ASTE officers for the coming year include, seated from left: W. Ballard, delegate; and L. Johnson, chairman. Standing are W. Bahnfleth, Jr., first vice chairman; T. F. Bain, second vice chairman; W. Bristow, secretary; and H. Austin, treasurer.

Shown above, smiling about the election results at Los Angeles, are the men chosen to guide the chapter's activities in the year to come. From left, they are: Paul E. Lenk, chairman; Ben Hazewinkel, first vice chairman; Alfred E. Beaumont, second vice chairman; George J. Tilden, secretary; J. A. Martin, treasurer; Past Chairman Francis X. Bale, national delegate.

Guiding lights of Little Rhody chapter for 1957-58 will be the officers shown here. From left are: Paul Watelet, national delegate; Karl Friedland, second vice chairman; Horace Bennett, chairman; Gilbert Stafford, first vice chairman; and Bertrand Guindon, treasurer of the 1956-57 terms.

Newly elected Santa Clara Valley officers from left are: Howard W. Holt, first vice chairman; William H. Forbes, second vice chairman; Rudolph Komuchar, secretary; James S. Burnett, treasurer; William T. Wright, national delegate and adviser; and Carl F. Kaiser, alternate national delegate.

New officers who will be guiding Indianapolis activities are, from left: Richard Garber, chairman; Roy Erickson, first vice chairman; Murray Davidson, second vice chairman; Byron Confer, secretary; Robert Mewhinney, treasurer; and John Huser, delegate and outgoing chairman.

Hamilton's new officers are, from left: Jack Hillier, treasurer; Oreland McIntyre, secretary; Bill Durrant, third vice chairman; Reg Vincent, second vice chairman; Ralph Fechnay, first vice chairman; Harry Ward, chairman; and Joseph Sheldon, past chairman.

Officers elected by Long Beach chapter are, from left: J. H. Medford, chairman and alternate delegate; C. W. Ward, first vice chairman; G. C. Allen, second vice chairman; C. D. McNealy, secretary; J. A. Espy, treasurer; and R. E. Gariss, national delegate.

Retiring Chairman Henry Gotta is pictured welcoming new Hartford chapter officers: Harry W. Anderson, chairman; Paul Dillberg, first vice chairman; Howard Wheeler, second vice chairman; and Paul Pick, treasurer. Douglas Proctor, incoming secretary, was not present.

Golden Gate's retiring chairman, Hans Metz, left, welcomes the incoming officers: Phil Freeman, chairman; Charles Driesbock, second vice chairman; John Wilson, treasurer; and Cliff Marker, secretary.

Newly elected officers of Long Island chapter are, from left: Secretary Charles Vanderhoof; Second Vice Chairman Sheldon Meyers; Chairman Theodore Borecki; First Vice Chairman Jerome Barfus; Treasurer Don Griffing; and National Delegate John Hatter.

new chapter officers

Elected officers for 1957-58 at Erie chapter are, from left: Thomas G. Brown, treasurer; David J. Stout, secretary; Richard A. Banaszek, second vice chairman; Samuel A. Fiorenzo, first vice chairman; Henry W. Sedler, chairman; and David B. Schuler, 1956-57 chairman.

Houston Dispatch

High point of ASTE's 25th Annual Meeting and Convention held March 23-28 at the Shamrock-Hilton Hotel in Houston, Texas, was the gala Silver Anniversary celebration on the evening of March 25. At the banquet that night, the Society's new officers and directors were announced; the National Honor Awards and International Education Award winners were named; and the 37,000th member, Daniel J. Martin, was honored. The largest closed-circuit audio broadcast ever attempted served to install chapter officers in their areas all over the continent, and to charter the Society's first off-shore chapter, Sydney, Australia. Assistant Secretary of the Air Force Dudley C. Sharpe was the principal speaker.

The five-day convention offered a series of technical sessions covering the latest tool engineering techniques, including the most complete symposia on ceramic and plastic tooling to date, and a timely meeting concerning engineering behind an earth satellite launching.

Tours of local plants, a regional educators' conference, and the presentation of the newly established Eli Whitney Memorial Award to Louis Polk, Sheffield Corp. president, rounded out convention activities.

NATIONAL OFFICERS ELECTED

Harold E. Collins of Houston, Texas, was elected president of the Society by the Board of Directors, meeting on March 25. Selected to serve with him are:

First Vice President—George A. Goodwin, Dayton, Ohio
Second Vice President—Wayne Ewing, Los Angeles
Third Vice President—H. Dale Long, Chicago, Ill.
Fourth Vice President—William Moreland, Ashland, Ohio
Treasurer—John X. Ryneska, Lynn, Mass.
Secretary—David A. Schrom, York, Pa.

DELEGATES CHOOSE BOARD OF DIRECTORS

Newly elected national directors, chosen by the House of Delegates, meeting in a closed session on March 24, are:

Edmund Hollingsworth of Philadelphia, Pa.
Frank F. Ford of Atlanta, Ga.

The new President, First, Second, Third Vice Presidents and the Treasurer were also elected to the Board of Directors.

Incumbent directors chosen to serve another term are:

Charles M. Smillie of Ferndale, Mich.
William A. Thomas of Windsor, Ont.
Philip R. Marsilius of Bridgeport, Conn.
Joseph L. Petz of Pleasant Valley, N. Y.
Leslie C. Seager of Salt Lake City, Utah
Gustave B. Berlien of Oakland, Calif.
Irving H. Buck of Dallas, Texas

As prescribed by the ASTE Constitution, Howard C. McMillen, retiring president of the Society, will be the fifteenth member of the Board.

EDUCATION AWARD WINNERS ANNOUNCED

Scholarships amounting to $700 each were awarded to the following university students for pursuing tool engineering studies:

Lawrence W. Miller, Case Institute of Technology
Peter C. Fishburn, Pennsylvania State University
William H. Bardens, University of Illinois
Richard W. Warkentin, Queens University, Canada
Porter J. Clark, University of Kansas
Paul H. Newell, Jr., University of Tennessee
Harold A. Cantrill, California State Polytechnical College
Richard L. Barnoski, University of Missouri
Robert K. Burroughs, University of Cincinnati
Phillip F. Myers, Ohio State University

FIRST OFF-SHORE CHAPTER CHARTERED

Radio-telephone connections between Houston and Australia made the long-distance chartering of ASTE's first off-shore chapter, Sydney, a reality, at the Silver Anniversary proceedings Monday night, March 25. Simultaneously, in Sydney, over 100 members-to-be were celebrating the chartering at a luncheon meeting, since there it was noon of the following day, March 26.

President McMillen administered the oath of office to the officers of the new group, and their response was heard in all chapters over the United States and Canada through the medium of the closed-circuit broadcast.

Charter officers of the Sydney chapter are as follows:

Chairman—Jack Finlay, retired manager of the Commonwealth Small Arms Factory, and known locally as the "father" of tool engineering in Australia.

First Vice Chairman—C. Curtis chief tooling engineer of the J. N. Kirby Mfg. Pty. Ltd.

Second Vice Chairman—R. Howell, works manager of Fotek Corp., Pty. Ltd.

Secretary—H. Colton, chief manufacturing engineer, Standard Telephones & Cables, Pty. Ltd.

Treasurer—Miss O. Symons, senior inspector m/c of the Shop Division, Standard Telephones and Cables, Pty. Ltd.

American Society of Tool Engineers...

1957 ANNUAL REPORT

"Without tools man is nothing, with tools he is all"...CARLYLE

The future lies ahead, unknown and unlimited . . .
a continuing challenge to the creative mind of man.

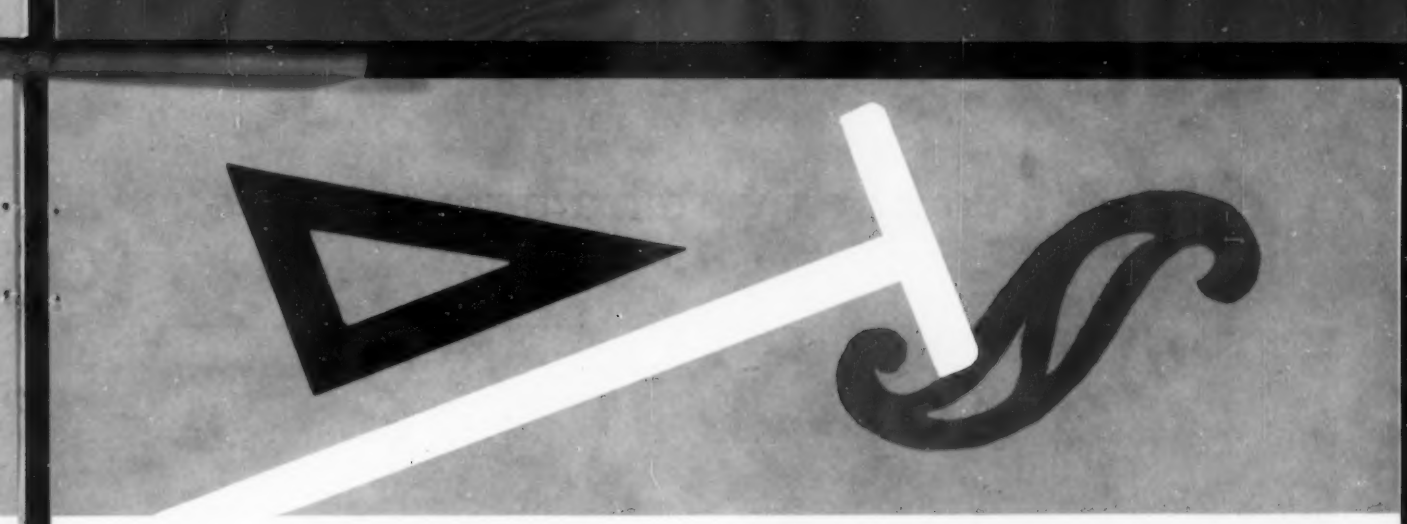
A N N U A L R E P O R T

Celebration of our Silver Anniversary makes this more than an Annual Report. We must acknowledge the impressive contributions which have been made by the Society's leadership and members over the past quarter century. Without their dedicated and constructive efforts it would not have been possible to conclude this very successful era.

Accomplishments of our Society have been based upon a steadily growing service to the membership and particularly to the industrial communities which our chapters serve. Countless opportunities for service have challenged our leaders who have met the problems and accepted the associated responsibilities with enthusiasm.

We are deeply aware of our debt to those who have pioneered and built our Society. Its accomplishments at the end of this significant period provide a firm base on which to build even better during the next twenty-five years.

The following summaries of National Committee activities do not do justice to the fine contribution each has made during the past year. I believe, however, that you will have a real appreciation of their accomplishments even though reported briefly.



MEMBERSHIP: Phenomenal membership growth in the past twenty-five years has placed our Society in the ranks of the largest engineering groups in the country. This dynamic membership makes possible the Society's aims of serving the profession and achieving public recognition for the accomplishments of its members.

The Society has 143 chapters in the United States and Canada, one off-shore chapter in Sydney, Australia, and 16 student chapters at foremost educational institutions. Shown in the accompanying map are the locations and names of these chapters.

Since the last Annual Meeting sixteen chapters have been installed. These include: Schuylkill Valley, Raleigh-Durham, Lorain County, Mansfield, Ottawa Valley, Kokomo, Trenton-Delaware Valley, Ozark, Southeast Kansas, Mississippi, Macomb, Birmingham, Canton Agricultural and Technical, University of Wichita, Long Beach City College and Southern Technical Institute.

FINANCIAL: Although services for the membership are of paramount importance, the existence of the Society and its ability to perform these services are dependent upon finances. The Financial Committee carefully studies the assets, liabilities, reserves, income and expenses of the Society. The financial position of the Society is favorable as shown in the accompanying balance sheet and charts of income and expense. The balance sheet shows our net worth as $1,473,186.

Based on the fiscal years 1954-55 and 1955-56, services to the profession and to industry amounted to $53.83 for each member. Compared with corresponding figures for the preceding year, the income per member increased $8.66.

PROFESSIONAL ENGINEERING: To gain professional recognition of tool engineering and of the Society, this committee assists members interested in professional registration. It collects and disseminates professional engineering information and renders advice and assistance to individual chapters and members on professional questions.

Included in this committee's objectives are: encouraging the professional growth of tool engineers, planning tool engineering courses for colleges and universities, fostering employee education, and making available refresher and preparatory courses for members.

HONOR AWARDS: Two new honor awards bring to a total of six the awards presented at the Annual Meeting. The new awards are ASTE Education Award and ASTE Research Medal. The others are ASTE Progress Award, ASTE Gold Medal, Joseph A. Siegel Memorial Award, and ASTE Engineering Citation.

Frederick Preator, head, tool engineering department, Utah State Agricultural College, receives the ASTE Education Award. Hans Ernst, director of research, Cincinnati Milling Machine Co., receives the ASTE Research Medal. Dr. Earle Buckingham, technical director, Geartronics, Inc., is awarded the ASTE Gold Medal. Louis F. Polk, president, The Sheffield Corp., and vice president, the Bendix Aviation Corp., is honored by the ASTE Engineering Citation. Frank A. Shuler, past president of ASTE, is endowed with the Joseph A. Siegel Memorial Award. Harry F. Vickers, president, Sperry Rand Corp., receives the ASTE Progress Award.

144 society chapters serve

ASTE CHAPTERS

1. Detroit
2. Racine
3. Cleveland
4. Milwaukee
5. Chicago
6. Fairfield County
7. Hartford
8. Pittsburgh
9. Toledo
10. Buffalo-Niagara Frontier
11. Twin Cities
12. Rockford
13. Baltimore
14. Northern New Jersey
15. Philadelphia
16. Rochester
17. St. Louis
18. Dayton
19. Syracuse
20. Schenectady
21. Cincinnati
22. Central Pennsylvania
23. Tri-Cities
24. Elmira
25. Worcester
26. Toronto
27. Los Angeles
28. Golden Gate
29. Houston
30. South Bend
31. Peoria
32. Springfield (Mass.)
33. Boston
34. Greater New York
35. Binghamton
36. Columbus
37. Indianapolis
38. Western Michigan
39. Seattle
40. Twin States
41. New Haven
42. Hamilton
43. Nashville
44. San Diego
45. Fond du Lac
46. Portland (Maine)
47. Akron
48. Potomac
49. Williamsport
50. Montreal
51. North Texas
52. Wichita
53. Little Rhody
54. Louisville
55. Windsor
56. Fort Wayne
57. Kansas City
58. Decatur
59. (Inactive)
60. New Orleans
61. Atlanta
62. Erie
63. Portland (Oregon)
64. Springfield (Illinois)
65. Niagara District
66. Richmond
67. Phoenix
68. Saginaw Valley
69. Oakland County
70. Muncie
71. Cedar Rapids
72. Fox River Valley
73. Evansville
74. Mid-Hudson
75. Madison
76. Springfield (Ohio)
77. Denver
78. Mohawk Valley
79. Ann Arbor Area
80. Des Moines
81. Grand River Valley
82. Piedmont
83. Lehigh Valley
84. Long Beach
85. Salt Lake City
86. Granite State
87. Jackson
88. Long Island
89. Greater Lancaster
90. Tulsa
91. London-St. Thomas
92. Los Alamos
93. Albuquerque
94. Peterborough
95. San Gabriel Valley
96. La Crosse
97. Lima
98. Santa Clara Valley
99. San Fernando Valley
100. Northern Massachusetts
101. Keystone
102. Paterson
103. Nebraska
104. Louis Joliet
105. Memphis
106. Tucson
107. Knoxville-Oak Ridge
108. Chautauqua-Warren
109. Lansing
110. Canton
111. Muskegon
112. Calumet Area
113. Merrimack Valley
114. Hendrick Hudson
115. Western Reserve
116. Kalamazoo
117. Battle Creek
118. Southeastern Massachusetts
119. Santa Ana Valley
120. Benton Harbor-St. Joseph
121. San Antonio
122. Riverside
123. Little Rock
124. Monadnock
125. Oklahoma City
126. East Texas
127. Ashtabula County
128. Northwestern Pennsylvania
129. Centinela Valley
130. Monmouth
131. Elkhart-Goshen
132. Schuylkill Valley
133. Raleigh-Durham
134. Lorain County
135. Mansfield
136. Ottawa
137. Kokomo
138. Trenton-Delaware Valley
139. Ozark
140. Southeast Kansas
141. Mississippi
142. Macomb County
143. Birmingham
144. Sydney, Australia

STUDENT CHAPTERS

University of Michigan
Utah State College
University of Kansas
Wayne State University
Alfred State Technical Institute
Purdue University
Wentworth Institute
Franklin Technical Institute
City College of New York
Mohawk Valley Technical Institute
Lawrence Institute of Technology
California State Polytechnic College
Canton Ag. & Tech. Institute
University of Wichita
Long Beach City College
Southern Technical Institute

strategic industrial areas

EDUCATION: This committee keeps the Society abreast of educational activities on a national level and serves on a consulting basis for establishing educational curricula.

An ever-increasing interest in tool engineering is exhibited by colleges and universities. A growing number of on-campus conferences has been held, sponsored by a group of Society chapters and this committee. These conferences provide engineering information for members and impress industry, the school and students with the importance of tool engineering. In addition, an extensive amount of work has been done in stimulating cooperation between industry and education in connection with the Delegates' 12-Month Plan.

INDUSTRIAL EXPOSITIONS: ASTE's Industrial Expositions provide an unparalleled educational asset to the Society. Leading manufacturers exhibit the latest developments in tooling, machines, processes and methods at these shows which have gained widespread recognition among the country's best expositions.

These expositions, conducted biennially, aid the tool engineer in keeping abreast of newest production methods. The 1956 Industrial Exposition was the largest show in the Society's history, with over 500 exhibitors displaying their products.

PROGRAMS: Program for the Silver Anniversary Meeting included the first Annual Eli Whitney Memorial Lecture, as well as symposia on ceramic and plastic tooling, and a session on engineering behind an earth satellite launching.

Also, the Program Committee has been assisting in developing chapter programs to promote greater attendance and build a stronger ASTE. It has inaugurated, on a trial basis, program clinics in sixteen locations throughout this country and Canada.

Chapter program chairmen were provided with a completely new and revised speakers' directory in addition to "ASTE Suggestions to Speakers" which was developed to assist chapter program chairmen.

EDITORIAL: THE TOOL ENGINEER articles are selected to meet the widely diversified needs of our members. To insure the magazine's development in the right direction, an independently conducted readership survey is used to indicate which sections and what subject matter are most widely read.

During the calendar year of 1956, more than 140,000 copies of forty articles published in the magazine were reprinted by industry. During this period, 1440 pages of editorial were published, 292 of which were devoted to Society news and activities.

The ASTE News Section continues to keep the membership posted on important projects and events through feature articles. Special consideration has been given to unusual chapter activities as growth of the Society continues.

STANDARDS: This committee represents the Society in all standards activities carried on by other national organizations such as the American Standards Association, Canadian Standards Association, and Joint Industry Conference.

Through its Carbide Subcommittee a proposed standard has been developed on brazed single-point tools, solid carbide tool bits, on-end carbide inserts and their holders. This committee is now working on a standard for throw-away inserts.

The NSC Tool Steel Subcommittee has completed its assignment of recommending specific tool steels for application to any particular end use.

TECHNICAL PUBLICATIONS: Formerly known as the Book Committee, the National Technical Publications Committee is now revising, writing and collecting data for the following books: the *Tool Engineers Handbook; Handbook*

AMERICAN SOCIETY OF TOOL ENGINEERS

BALANCE SHEET JANUARY 31, 1957

ASSETS

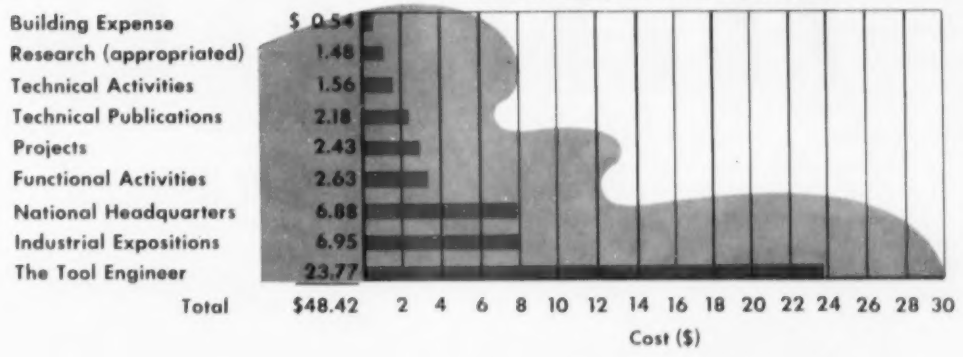
Current Assets		
Cash on hand and in banks	$	89,697.15
Accounts Receivable		34,044.98
United States and Canadian Bonds		464,082.00
Treasury Bills		545,785.50
Inventories		65,842.24
Total Current Assets		$1,199,451.87
Fixed Assets		
Land	$	40,438.40
Land Improvements		8,610.21
Building		132,451.02
Automobile		2,057.00
Furniture and Fixtures		74,280.04
Total Fixed Assets	$	257,836.67
Other Assets		
Deposits with Others	$	2,472.52
Travel Advance		2,250.00
Def. Exp. 1958 Show		1,607.30
Investments		150,000.00
Total Other Assets	$	156,329.82
Total Assets		$1,613,618.36

LIABILITIES AND NET WORTH

Current Liabilities		
Accounts Payable Chapter	$	9,715.74
Accounts Payable Membership Pending		4,970.00
Accounts Payable Misc.		13,425.42
Accounts Payable Suspense		73.73
Prepaid Advertising		4,768.70
Research Fund		100,000.00
Deposits—Book Orders and Cert.		480.25
Accrued F. O. A. B.		1,047.47
Employees Pension Fund		2,942.12
Accrued Agency Commission		763.65
Award Deposits		2,245.00
Total Current Liabilities	$	140,432.08
Net Worth		$1,473,186.28
Total Liabilities and Net Worth		$1,613,618.36

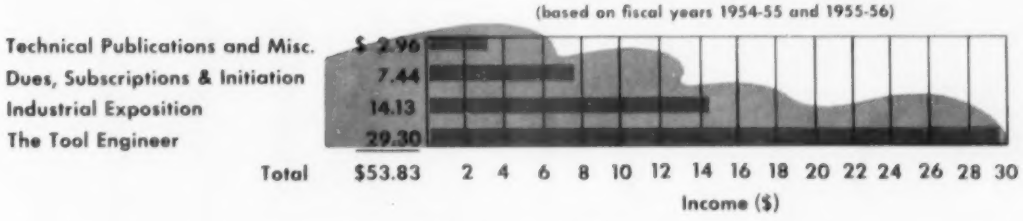
COST OF SERVICE PER MEMBER PER YEAR*

(based on fiscal years 1954-55 and 1955-56)



INCOME PER MEMBER PER YEAR

(based on fiscal years 1954-55 and 1955-56)


Technical Publications and Misc. $ 2.96
Dues, Subscriptions & Initiation 7.44
Industrial Exposition 14.13
The Tool Engineer 29.30
Total $53.83
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Income ($)

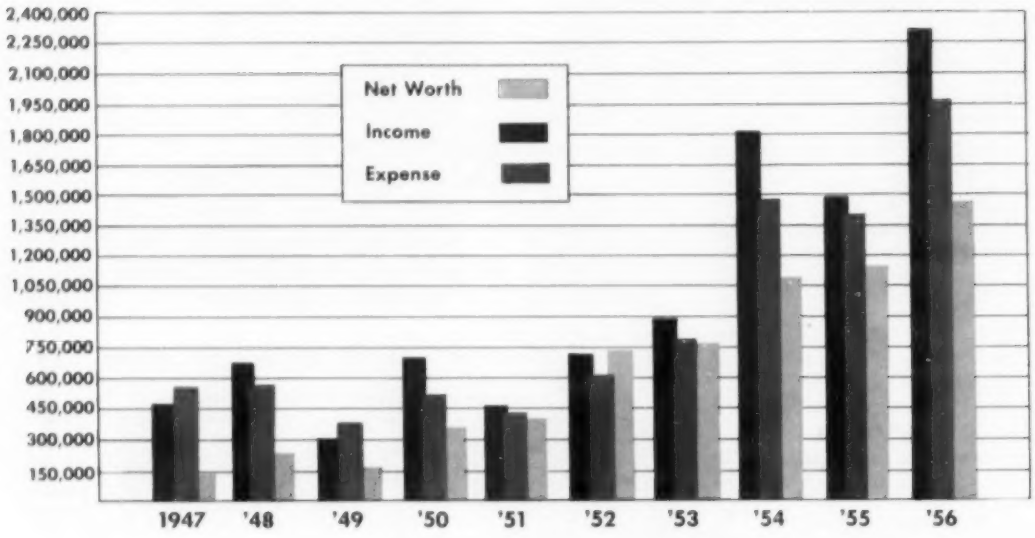
*Average membership during the period was 33,715

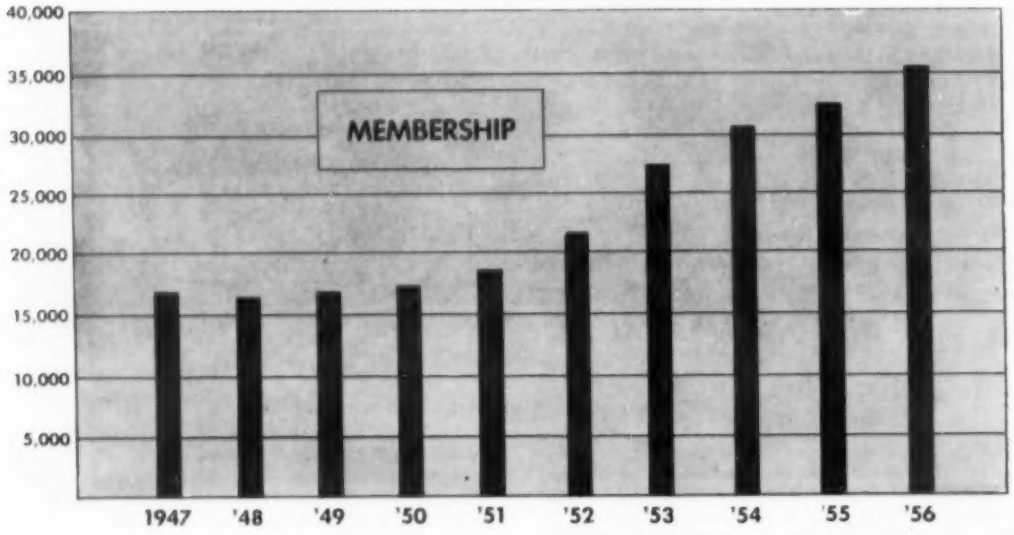
This bar chart for income and expense illustrates the multiple dividends received by each member in addition to invaluable technical information. With an average investment of $7.44, each member received services in various forms from the Society amounting to $48.42, a return of 650% of his investment in national operations.

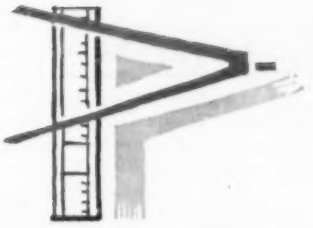
In the balance sheet at the top of this page are shown the assets, liabilities and net worth of the Society. This portrays its strong financial structure, its net worth being almost $1½ million.

GROWTH at a glance

1947 — 1956







of Process Planning and Estimating; Jig and Fixture Design; and *Planning and Tooling for Powder Metal Parts.*

Other projects for books, now in their infancy, include machining with carbides and oxides, and the study of aircraft manufacturing and tooling.

Increased local chapter participation is being encouraged to support the expanded book building program. Each chapter now has its own Technical Publications Committee.

RESEARCH: With three years of active operation drawing to a close, the Research Fund Committee continues to expand its activities and to gain increasing acceptance from industry.

Two projects completed during the year were: "The Evaluation of the Mist Method of Applying Cutting Fluids" and "A Study of the Metal Borides." The first was completed at MIT and reported by Professors Shaw and Smith. A partial report was given as a paper at the 24th Annual Meeting. The complete report is to be issued shortly. The second project was reported in full in a paper delivered by Dr. Metcalfe at the last Annual Meeting. A year's continuation of both of these projects has been approved by the committee on the recommendation of the steering committees.

The Research Fund Committee has also undertaken three long-range programs: metal-cutting, plastic tooling, and metal stamping.

CONSTITUTION AND BYLAWS: This committee assists chapters in interpretations of the Constitution and Bylaws. It was assigned the projects of studying the functions of the chairman of the House of Delegates Meeting, the chartering of off-shore chapters and revising of the rules for student chapters.

PUBLIC RELATIONS: This committee is responsible for keeping the public informed of the Society's progress and maintaining continued goodwill.

The committee has prepared and distributed *The First Tool Engineer; Automation—What's Ahead?; Where Do Engineers Work in Industry?;* the chapter public relations kit, and the 1956 Chicago Tool Show and House of Delegates movie. This 15-minute color and sound motion picture is available for chapter use. More than 100 chapters have already seen the film.

An additonal activity was administration of the Delegates' 12-Month Industry and Education program, which was conducted at chapter level.

JUDICIAL: Nine presidents make up this committee which has the authority to render final decision regarding an interpretation of the Constitution and Bylaws Committee in cases where the decisions of the National Constitution and Bylaws Committee are not accepted.

PROGRESS: Continual study of Society operations on a national and chapter level and an evaluation of these in relation to the objectives of ASTE is the job of the Progress Committee. This important committee continues its detailed study of "Five-Year Plans" for committees and reports significant findings to the Board. It assists the committees in thinking of the future and in making long-range planning. It is evident from each national committee's remarkable progress during the past year that our Society's primary purpose, that of providing media for exchange of technical experiences and assistance in individual self-improvement of the members in their technical craft, is being carried out.

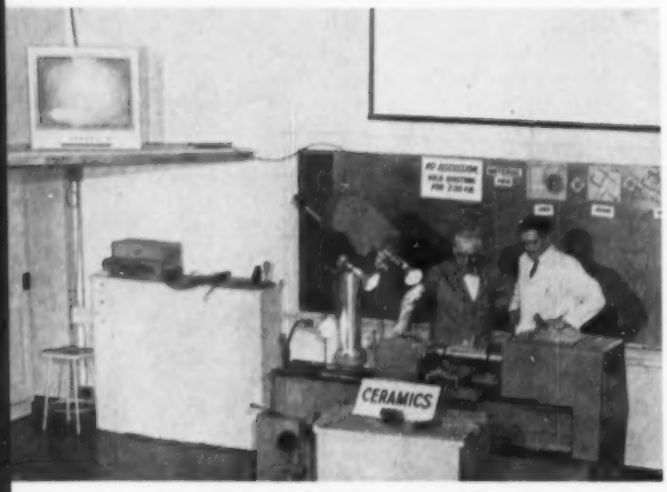
CONCLUSION: The operation of our Society has been conducted in a business-like manner with carefully planned balance of the many Society activities. Coordination of effort between committees and with Headquarters' staff has contributed much to our progress. I am personally grateful to all those in our organization who have done so much to make my responsibilities lighter during this past year. It has been an honor to serve as President. I shall always remember with pleasure my experiences and, best of all, the many friendships that I have made.

Submitted for and on behalf of the Board of Directors and National Officers

H. C. McMillen

President and Chairman of the Board

Two Universities Schedule On-Campus Conferences



Tooling demonstrations such as this are an important part of educational conferences. Here the TV camera gives visual aid to the audience of a technical session

With the advent of spring, on-campus conferences begin to flourish across the nation. April will see two universities, Purdue and the State University of Iowa, opening their doors to conferees looking for the latest in tooling techniques and the science of engineering.

On April 13, the Third Annual College Industry Conference will be held on the campus of the State University of Iowa at Iowa City. Sponsored by the Cedar Rapids chapter of ASTE in conjunction with the university, the conference will have as its theme, "New Processes and Developments in Industry." In addition to the technical sessions, the planning committee has provided for a tour through the college M.E. labs for the men, and a visit to the University Hospitals for the ladies.

Subjects to be dealt with during the morning sessions are carbon dioxide welding, electroforming, plastics potting and encapsulating, acid etching of precison parts, and cemented oxides.

Afternoon sessions will be concerned with tape-controlled machines, hydroforming and hydrospinning, chemical milling, ceramics for metal-cutting, hot extrusion of metals, and ceramics.

Advance registration and further information can be obtained for the Iowa conference by writing or wiring Prof. E. M. Mielnik of the university's mechanical engineering department.

"Profits through Tooling" is the theme around which the April 27 Purdue On-Campus Conference s planned, according to Orville D. Lascoe, professor of industrial engineering, who is conference chairman. Two main technical sessions will serve to expand this theme. They will be augmented with visits to the engineering labs, industrial exhibits and special tooling demonstrations, and by a 30-minute commentary on "Engineering Education Today" by Dr. A. R. Spalding, head of Purdue's School of Freshman Engineering. Chairmen of ASTE chapters in the Indiana Council, one of the sponsoring bodies, will preside at the meetings.

The first technical session will cover "Cold-Working of Metals for Production and Profits," a panel discussion by men with considerable industrial experience in cold roll-forming techniques and cold-heading processes. The afternoon session on "Practical Applications of Oxide Tooling" will first provide a panel of industrial experts speaking on toolmaking, inspection, production applications, and effects of machine tool selection and design on ceramic tools. Following the panel, Professor Lascoe and R. W. McDowell will present the Purdue University report on ceramic cutting tool research.

Dr. G. A. Hawkins, dean of the schools of engineering, will welcome conferees at a general session at 10 a.m. Luncheon in the Union Building will be highlighted by immediate Past President H. C. McMillen as toastmaster; Purdue University President Fred L. Hovde will add his welcome to the group.

Dean of Men O. D. Roberts, speaker at the evening banquet, has chosen "The College Student and His Problems" as his subject. Toastmaster will be R. E. McKee, chairman of the Society's National Education Committee, another conference sponsor.

The women's interests have not been neglected, as proved by the following ladies' program. The morning schedule includes an exhibit of metalcrafts and a demonstration of the Purdue-developed "master-mix" and cake mix. Following luncheon with a style show by a Lafayette dress shop, the ladies will see a program presented by the university's modern dance classes. After campus visits and tours, they will join their husbands in the South Ballroom of the Union for the joint dinner meeting.

Diamond Tools Topic at St. Louis

A full program was lined up for Feb. 7 at St. Louis, including election of officers, old timers night and a talk on diamonds. Jan Taeyaerts, president, Precision Diamond Tool Co., and president of the Industrial Diamond Assn., discussed the mining of diamonds and their eventual usefulness as industrial diamond cutting tools. Mr. Taeyaerts showed a film depicting the steps in the manufacture of diamond tools.

Newly elected officers include: Vince Bene, chairman; Charlton Brown, first vice chairman; Kenneth Ritter, second vice chairman; Frank C. Schillinger, treasurer; and Paulena Pagel, secretary.

—W. A. Scheublein, Jr.

SANTA CLARA VALLEY—Jim Coulter, past chairman of Golden Gate and member of the National Program Committee; and William T. Wright, chapter chairman, are shown with speaker of the evening, Joseph H. Bungartz of Cincinnati Milling & Grinding Machine Co., who discussed "Profile Milling." *—W. H. Forbes*

Granite State Tours Plant

John J. Gilbert, ocean cable engineer, spoke to Granite State chapter when it toured the Simplex Wire and Cable Co. Mr. Gilbert discussed the developments that led to the first transatlantic telephone cable.

Elections took place at the Rockingham Hotel. New officers include: Joseph Russo, chairman; Fred Wakefield, first vice chairman; Robert Ellison, second vice chairman; Richard Downing, secretary; Carmel Radwan, treasurer; Gino Magnani, delegate; and Jacob Repetto, alternate delegate. *—Norman Fine*

chapter news and views

Powder Metallurgy Discussed at Fairfield

"Pitney Bowes Night" was the title of the January meeting arranged by Arnold Schultz of Pitney Bowes. Matthew F. O'Brien, manager of methods and tools, acted as toastmaster. The main subject of the meeting was "Powder Metallurgy," which was presented by Bradford I. Horton, staff engineer. Coffee Speaker Allen, vice president in charge of manufacturing, gave a talk on the history of Pitney Bowes.

Battle Creek Holds Elections

Battle Creek Chapter elected Arthur Damon, statistical quality control engineer for the Eaton Mfg. Co., Aircraft Div., as chapter chairman for a one-year term to succeed Lionel Anderson. Other officers named were: Jack Gray, first vice chairman; Russell Childs, second vice chairman; Dave Nagao, secretary; and Charles Larson, treasurer. The election was held at the regular dinner meeting at the American Legion.

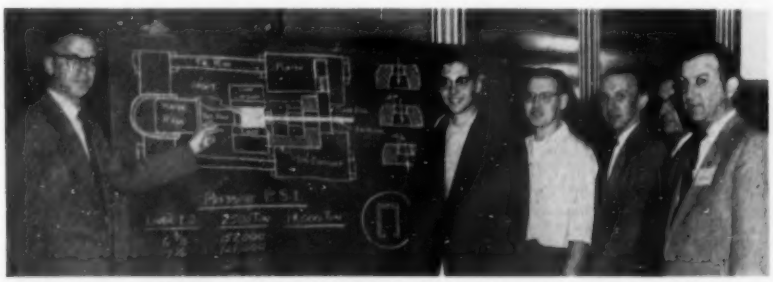
Springfield To Hold Regional Conference

May 3 is the date set for the New England Regional Conference of ASTE, sponsored by the Springfield, Massachusetts chapter. The program will include plant tours, a luncheon meeting, technical sessions, and a social hour and banquet. The Sheraton Kimball Hotel, Springfield, will be conference headquarters.

Following registration at 8:30 a.m., the morning will be devoted to visiting the following plants: American Bosch, Division of American Bosch Arma Corporation; A. G. Spalding Brothers; the Van Norman Company; and Westinghouse Electric Corporation.

Two topics will be featured at the afternoon technical sessions. "High Speed Photography as Applied to Tooling" will be a panel discussion comprised of representatives from Eastman Kodak, Wollensak Optical Company, and Fairchild Camera. The second session is titled "Brainstorming for New Ideas."

The luncheon speaker will be James Low, of the National Association of Manufacturers.



PURDUE UNIVERSITY—M. W. Mahns, die superintendent of Alcoa's Lafayette plant, gave student chapter members a briefing on the processes they would see during a plant tour of his company. Ready for the tour are, from left: chapter officers, John McMillen, chairman; Fred Bydash, treasurer; Donald Buesnagel, secretary; tool engineer, J. H. Wheeler; and technical supervisor, G. W. Eberle. *—Terrance B. Lindemer*

Chapter News and Views

LOS ANGELES—Membership committeeman, Glen Crider, left, welcomes new members to the ranks. With him in the front row, from left, are Chris Mann, Robert Exline, Jack Bruce, and Elmer Childress. Standing in the back row are Robert Wall, John Morgan, Richard Whitton, and Ernest Szabo.

Three Speakers Spark Mid-Hudson Program

Theodore G. Clement, design coordinator of Eastman Kodak Co., handled the speaking assignment for the technical part of a recent meeting at Mid-Hudson. He pointed out the importance of learning from mistakes in order to keep ahead of competition. He also recommended the wise use of market analysis and sales trends as among the best methods of determining design policy and production estimates. To illustrate, Mr. Clement showed slides of possible design changes, and described the methods used to decide on the final product.

Two other speakers shared the bill with Mr. Clement. From headquarters, Frank W. Wilson, ASTE technical director, briefed the audience on the forthcoming technical publications of the Society, and voiced his appreciation of the excellent job done by the chapter book committees. He mentioned particularly the contribution of Mid-Hudson's Vincent J. Cavalieri.

Coffee Speaker John M. Miller, captain of Eastern Airlines' flight from New York to Houston, Texas, searched through his 33 years of flying experience to recount some of the highlights of aviation history. He contrasted the day when Glenn Curtis, on his record flight from Albany to New York City in 1910, refueled at Poughkeepsie, using a 5-gallon can, with the present time, when planes such as his use 500 gallons of fuel an hour. Mr. Miller predicted great strides to be made in electronically controlling aircraft during landing. *—Atilla G. V. de Illy*

Position Available

INDUSTRIAL ENGINEERING—Teachers at San Francisco Bay Area College. Expanding program; $4-million building addition now being planned; excellent part-time industrial and graduate work opportunities; excellent salary scale. Write to Head, Engineering Dept., San Jose State College, San Jose 14, Calif.

Positions Wanted

INDUSTRIAL SALES—Member desires line or lines for Upper New York territory. Ten-year proved sales record selling to industrial supply houses and metal-working trade, for a national manufacturer. Prefer lines into cutting, power, production or measuring tool category. Additional personnel available. Write to: Box 092, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

ESTABLISHED MANUFACTURER'S REPRESENTATIVE—desires to represent in state of Michigan a manufacturer of coil stock feeders for die automation. Write to: Box 097, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

WANTED TO REPRESENT—Die Shop for state of Michigan except Detroit by established manufacturer's representative. Write to: Box 096, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Wichita Discusses Tool Efficiency

Harry Conn, chief engineer, Scully-Jones & Co., presented a talk Feb. 13 on a new system called "Economical Tool Efficiency." The second half of the program was devoted to election of officers: Paul Hess, chairman; Jim Hill, first vice chairman; Bill Unruh, second vice chairman; Dave Duffy, third vice chairman; Jess Erickson, secretary; and W. F. Rutschman, treasurer.

Members entertained their wives and guest couples on Feb. 16 at their annual ladies night. *—James Hill*

Lansing Hears of Milling Processes

Gerald Declair, Chrysler Corp., Gas Turbine Power Plant Research Div., spoke to the chapter on gas turbine engines and their applications in automobiles. At a later chapter meeting Lansing learned of the development of milling processes when addressed by Karl B. Kaiser, chief engineer, Ingersoll Milling Machine Co. Officers elected are: Lyman Mack, chairman; Keith Williams, first vice chairman; Harvey Robey, second vice chairman; Millard King, secretary; Bob Adams, Jr., treasurer; Glenn L. Crippen, national delegate; and William Janetzke, alternate.

California Polytech Topic Is Investment Casting

Dick Ells, owner of the Dick Ells Co., spoke at the February meeting on the development of investment casting in the Los Angeles area. Questions from the floor indicated that the students present were interested in this method for the production of turbine blades for automobiles in the future.

Ceramic tooling was the subject Edward Kibbit of Stupalox presented at the January meeting. He pointed out the ability of aluminum oxide cutting tools to withstand high temperatures, making faster machining speeds possible. *—John F. Green*

New Welding Techniques Described at Long Island

The story of fusion welding and roll planishing tooling was brought before the members of Long Island chapter in February by Harlan Meredity, vice president of the Airline Welding and Engineering Corp. of Hawthorne, California.

At another recent meeting of Long Island, the subject of drop forging was covered by Robert Merrill, president of Merrill Brothers. *—R. Bradshaw*

Racine Tours Industrial Museum

Under the direction of William Glamm of A. O. Smith Corp., 96 Racine members participated in a three-hour plant tour. Mr. Glamm discussed the early history and development of the A. O. Smith Corp. and then led the group through the industrial museum where members were shown the old and new products of the company. From there the group went on to the pipe mill where 30 miles of large-diameter pipe is made in a day and finally to a demonstration of the latest welding techniques in the heavy vessel department. Members were shown slides which explained characteristics of the various welding methods.

At the monthly meeting, the following officers were elected: chairman, James Vernon; first vice chairman, LaVerne Hicks; second vice chairman, Robert Monfeli; secretary, Robert Heinrich; treasurer, Byron Peterson; and national delegate, retiring chairman, Vitas Thomas.

Speaker E. H. Flook of the National Automatic Tool Co. discussed automation. *—Alvin J. Michna*

Canadian Oil Is Topic at Niagara

Niagara District's February meeting was concerned with "Oils in Industry," presented by Howard Lowe, service engineer of the E. F. Houghton Co. Mr. Lowe described the various types of oils and their by-products.

Officers for the 1957-58 term were installed as follows: W. J. Pentesco, chairman; E. A. Lindwall, first vice chairman; W. C. Snider, second vice chairman; F. W. Bird, secretary; and A. V. Orr, treasurer. The past chairman, R. J. Meacher, was named national delegate.

The chapter's January meeting was devoted to a film on "Forging Practices in the United Kingdom," shown by J. G. Gill and W. Morgan of the Canadian Steel Improvement Ltd., Toronto.

—Frank W. Bird

ST. LOUIS—Proof that boys of all ages enjoy seeing and learning about jet planes, the Father and Sons Night program, featuring two McDonnell Aircraft Co. films of jet fighter planes met with the complete approval of the diners shown here at the meeting. Each dad and son received a color photo of jets in flight. *—W. A. Scheublein*

Macomb County Slate Unanimously Elected

On February 7, the newly chartered Macomb chapter, which draws its members from greater Detroit, Macomb County, Pontiac and Windsor, Canada areas, held its first full-term election. The slate presented by the nominating committee was unanimously accepted. New chapter officers are: Guy F. Scott, chairman; Charles Phelps, first vice chairman; Elmore Oakley, second vice chairman; Charles Carter, treasurer; and Richard Clark, secretary.

The technical session brought Ed M. Hakanson of The Sheffield Corp., Dayton, Ohio, before the membership, speaking on the "Crush-True" process of dressing grinding wheels. The talk was accompanied by films showing the process in operation, and followed by a lively discussion period.

At the January meeting chapter members toured the Rotary Electric Steel Corp. of Detroit. Before the tour Robert L. Farmer, industrial relations director of the company, furnished each member with a plan of the plant layout, and a letter inviting questions. Beginning in the melt shop, the tour progressed through the stripper shop, billet grinding and reconditioning building, stainless pickle and processing department, chipping room, bar mill, cold draw building and motor room, and ended an hour and a half later in the metallurgical laboratory. Of particular interest was the B. A. Dow—Model B direct reading spectrometer which indicated, in less than two minutes, the amounts of ten different elements in a sample of steel. The reading is taken from a spark generated between two pins made from the alloy being tested.

—Francis J. Busch

SYRACUSE—Members chat informally at the January dinner meeting. From the left are: Ken Walts, John Sauda, Carl Schmeling, Jack Eustace, Frank Ungeleich, Bob Metz, Glen Marte, and Eugene Morey. *—Paul H. Hansel*

TORONTO—Henry B. Sharpe, Jr., president of Brown & Sharpe Mfg. Co., spoke at the chapter's annual executive night recently on "Wider Horizons in Machinery Replacement." *—R. A. Flanagan*

chips and chatter

"Tooling with Ceramics" was the topic discussed at **Benton Harbor-St. Joseph** by Ray Jablonski, Carboloy Div., GE. In addition, new officers were elected: Robert Jones, chairman; Paul Broadstone, first vice chairman; Robert Potter, second vice chairman; Calvin Frappier, secretary; Earl Rock, treasurer; and Ivan Peters, delegate.

Binghamton chapter heard C. T. Appleton, president of the Reed Rolled Thread Die Co., give an illustrated talk on the principles and development of thread-rolling processes and their advantages. A large display of thread-rolled parts used in various industries was on exhibit.

"The Application of Oxide Cutting Tools" was the subject discussed at **Canton's** January meeting. Edward Kibbitt of The Carborundum Co. explained the part that high-strength sintered oxide tools play in industry.

Chicago's members and guests braved sub-zero temperature to hear Don Evans of General Electric and Otmar Teichmann of Borg-Warner Corp. discuss feed-back controls. Their discussion covered Selsyns, armature voltage controls, numerical program controls, magnetic tape and punch-card controls and hydraulic circuits used for automatic machinery.

Eighty-five attended Dayton election meeting at which George Brandt was elected chairman; Jack Copeland, first vice chairman; and Andrew Bailey, second vice chairman. Phil Glick of Chrysler Corp. presented a talk on "The Miracles of Metal Powder" and exhibited various products which could be made of powdered metal. George Goodwin, national vice president, discussed the Silver Anniversary meeting.

At **Erie** chapter's meeting Robert B. Way, president of the Finish Engineering Co., described tooling methods for multicolor detail painting of die castings, metal stampings and molded plastic parts. Using color movies and slides, Mr. Way demonstrated spray-painting techniques, the use of masking tools, painting and wiping machines.

Fort Wayne held its past chairmen's night and election on Feb. 13. W. W. Schug and C. H. Hamilton of Embart Mfg. Co. discussed feeding devices and progressive dies in punching and forming operations. On February 25, the chapter enjoyed a plant tour through the Zollner Foundry and attended the Zollner basketball game.

Fox River Valley heard Past President H. B. Osborn, Jr., technical director of the Ohio Crankshaft Co., speak on "Induction Heating and the Tool Engineer."

Joseph Bungartz of The Cincinnati Milling Machine Co. spoke to **Golden Gate** on milling of aircraft and guided missile parts.

Clarence Beingessner, president and general manager of the Precision Heat Treating Co., Ltd., spoke at **Grand River Valley's** meeting on the subject of heat treating. The slate of officers presented at this meeting included: chairman, Roy Robertson; first vice chairman, Gib Dilly; second vice chairman, Percy Bowman; third vice chairman, Ken Baird; secretary, Grant Johnstone; treasurer, Bill Little; delegate, Clayt Henderson; alternate, Roy Robertson.

A. W. Millward, equipment engineering supervisor, Tool and Gage Div., John Bertram & Sons Co. Ltd., spoke to **Hamilton District** chapter on automatic screw machine tooling. His talk was illustrated by slides which gave examples of tooling for both single and multi-spindle machines. W. A. Dawson, assisted by Vince Goldsworthy of Niagara District, gave a coffee talk on ASTE's numerical index system for filing catalogs and engineering data.

Houston chapter learned of modern broaching practices which was discussed by Joseph A. Psenka of the National Broach & Machine Co. Mr. Psenka described the principles of broaching, the design of broaches and the methods used in broach manufacturing.

John E. Lynch, manager of milling machine sales, Cincinnati Milling & Grinding Machines, Inc., spoke to **Indianapolis** members on "Modernization of American Metalworking Industry."

Kalamazoo learned about "CYPAK" as described by Speaker R. E. Connor of Westinghouse Electric Corp.

Western Electric's Allentown plant was the scene of a plant tour by members of the **Lehigh Valley** chapter recently. The fifty-four attending members covered all the manufacturing departments, and heard engineers at each station explain the processes performed there. Refreshments were served afterwards.

Little Rhody heard the answer to the question "What Is the Chamber of Commerce?" posed by William E. Harper. As consultant for the Industrial Div. of the Greater Providence Chamber of Commerce, Mr. Harper revealed some of the unusual and humorous requests submitted to the Chamber of Commerce, then turned to a more serious discussion of the helpful services available to the many small businesses in the area.

"Putting the Radial Drill to Work" was the subject John Hussey of the American Tool Works Co. discussed at **Long Beach.** Mr. Hussey presented the means of producing more work from the radial drill with the aid of self-indexing trunnion jigs. He stated that there is more consistent accuracy with this type of jig, that handling of parts is much easier and that time is saved.

David F. Cole was elected chairman of the **Mansfield** chapter during a meeting attended by 90 members. Others elected were: W. J. Burrer, Jr., first vice chairman; C. W. Brooking, second vice chairman; Ferd J. Loykovich, treasurer; D. D. Smith, secretary; J. Ward Ingraham, delegate; and D. F. Cole, alternate delegate.

Mid-Hudson learned of the "numericord and recordotrol" when David E. Laughlin of Giddings & Lewis Machine Tool Co. spoke to the group. Edward J. McCabe, assistant special agent in charge of New York office of FBI, presented an interesting talk on the FBI.

New officers elected are: J. H. Keller, chairman; Mike N. Hall, first vice chairman; H. J. Depew, second vice chairman; A. J. Larue, secretary; V. J. Cavalieri, treasurer; and F. N. Plotnik, national delegate.

Members attending **Milwaukee's** February meeting heard Edward McFaul, eminent speaker, teacher, and personnel manager, cover the topic "What Is Your Washroom Rating?" which dealt with the techniques to be used in handling foremen relationships at the supervisory level. The talk was followed by "Air Power," a color film shown through the courtesy of Capt. Eddie Rickenbacker. An election of officers resulted in the following men being chosen: George Riordan as chairman; L. A. Wacker as first vice chairman; Harvey Prill as second vice chairman; R. H. Bates as secretary; and Ralph Perlewitz as treasurer.

Mississippi heard W. E. Luoma of Dilworth of Mississippi speak on safety in the shop. "What's in It for Me?" was presented by the Mississippi Power & Light Co. in cooperation with the U. S. Fidelity and Guaranty Co. of Baltimore.

Harley H. Bixler, manager of G.E.'s manufacturing process development, addressed 129 members and guests of **Mohawk Valley** chapter, following a

tour of the Utica plant. A company-wide consultant on the fabrication and utilization of plastic tooling, Mr. Bixler talked on this subject, using slides and a display of plastic tooling to support his lecture.

C. A. Norgren Co.'s sales engineer, Delbert G. Faust, told the **Monadnock** members that the application of micro-fog lubrication is virtually limitless for machine tools and heavy equipment, at a recent technical session. He stressed its value in textile and paper making, where lubricants sometimes soil the product.

"Precision Form and Crush Grinding," a colored film on the manufacture of grinding machines at the Jones and Shipman factory in England, was shown at **Montreal**. E. B. Farndale and his associates from Jones and Shipman, Canada, also presented slides dealing with crush wheel dressing and contour grinding.

Joseph W. Hennen, president of Standard Mfg. Co., invited **Nebraska** members to tour his plant. In speaking to the group before the tour, he introduced his tool engineers and told of their successful automation of the plant. The ingenious solutions to the problem of automation were mentioned, and later demonstrated in the plant.

The following slate of officers for **New Haven** was unanimously accepted at the chapter's February meeting: chairman, George Griffiths; first vice chairman, Russell Applegate; second vice chairman, Chester Rybacki; secretary, Joseph Benson; and treasurer, Walter Fischer. At the technical session, Kenneth L. Bates discussed "The Grinding Wheel: Its Care and Use." At the previous meeting, a chemical engineer from du Pont, Richard Leary, brought illustrations and exhibits of machine parts such as gears, made from various plastics including nylon and dacron.

Elections at **Northwestern Pennsylvania** revealed the following men in charge for the coming year: Theodore Smeal, chairman; William Bell, first vice chairman; Donald Howard, second vice chairman; Donald Wilson, secretary; Robert Hauber, treasurer; and John McClure, delegate for 1957-58. At the same meeting F. E. Smith, president of Perry Equipment and Engineering Co., spoke on the design and application of parts feeders. At an earlier date, T. J. Donovan of Sylvania Electric Products covered the topic of heat treating of steels.

Ottawa Valley heard E. B. Farndale, Jones and Shipman Canada, Ltd., present a picture of the precision grinding requirements dictated by modern industry, and the advances made to meet this demand.

NIAGARA DISTRICT—K. Jones, chairman of the newly formed standards committee of the chapter stands to check the reports of his committeemen. They are, from left: L. Butticci; D. Hoggan, chapter secretary; J. Sullivan; and E. A. Lindwall, second vice chairman, and organizer of both standards and book committees. *—Frank W. Bird*

ROCKFORD—Past Chairman Alfred Oman, left, chats with Dr. Richard Humphreys, assistant director, Armour Research Foundation of Illinois Tech, who spoke on atomic energy at a recent meeting. *—Larry Geiger*

NORTH TEXAS—Pictured are some of the special guests and executives from the major industries in North Texas area, associated with the tooling field, who attended Executive Night. A film of the 1956 convention was shown and Vice President Wayne Ewing spoke on "The Value of ASTE to Management." *—R. T. Parker*

chips and chatter

Williamson Trade School, Media, Pa., was visited by **Philadelphia** members as a chapter function. They toured the facilities of the school, which picks 160 boys, mostly fatherless, for their high scholastic records, and teaches them various trades, from machine shop to carpentry. Technical speaker was Jack Kleinoder, a vice president of National Tool and Diemakers Association, who talked on the need for a planned apprentice training program.

Edward Kibbitt from The Carborundum Co.'s Stupakoff Div. presented the applications and limitations of ceramic tools to members of **Phoenix** and **Portland, Me.,** recently.

H. G. Brustlin, district manager, Norton Abrasive Div., presented a film "Grits and Grind," on Jan. 17 to **Portland, Oregon,** which was followed by a panel discussion including Mr. Brustlin, Art Cox, and George Bogue. On Feb. 21, members, ladies and guests toured one of the largest mills of the northwest, Crown, Zellerbach Paper Mills.

Following J. L. Lovett's presentation of **ultrasonic machining,** the following **Riverside** chapter officers were elected: Hugh Foster, chairman; Philip Christoffersen, first vice chairman; Glen Porter, second vice chairman; Jim Diamond, secretary; Oral Piercey, treasurer; Edward Busher, delegate; and Les Huestis, alternate delegate.

Pacific Telephone Co.'s Roy Alford and the Douglas Aircraft Corp. joined forces to bring the story of the Nike missile and radar to **San Fernando Valley.**

Santa Ana Valley's election put the following men at the chapter's helm: Roy Connelly, chairman; Jim Rust, first vice chairman; Don McInnis, second vice chairman; Don Eels, secretary; Harry Vance, treasurer; Dave Reichert, national delegate; and Roy Connelly, alternate. John Hussey spoke on "Putting the Radial Drill to Work." Harry Brustlin and Robert Cooper of Norton Co. described the use of diamond wheels at the previous meeting.

Schuylkill Valley's election night speaker was Kenneth Christopherson, George Gorton Machine Co., who talked on contour milling and two and three-dimensional shapes. The new officers will be: J. H. Quinn, Jr., chairman; N. A. Flemming, first vice chairman; William F. Huyett, second vice chairman; A. J. Paulsgrove, secretary; C. R. Fegley, treasurer; J. F. Kroener, delegate; and R. O. Heiser, alternate delegate.

Automatic gaging in various types of inspections was discussed by J. Stewart Broach of Pratt & Whitney, when he addressed **Springfield, Mass.** in February.

James F. Bell, associate judge of the Ohio Supreme Court, drew an attendance of 57 members and their 55 guests, all civic and industrial leaders, at **Springfield, Ohio's** seventh annual Executives Night. His talk titled "Behave Yourself," dealt with the effect of human behavior on home and community.

The first technical meeting of 1957 at **Syracuse** brought Dr. G. N. Butler, research manager of The Carborundum Co., reviewing the research programs on grinding that are now in progress at his company and MIT.

THE TOOL ENGINEER's associate editor, Ralph Eshelman, described the educational background needed for "Tomorrow's Tool Engineer" at **Toledo's** Education Night program. Guests were faculty members and students from local high schools.

Tri-Cities chapter heard J. H. Dubois, vice president of **Mycalex Corp.** describe new insulation materials developed by his company, in a recent talk.

Radioactive cobalt therapy was the topic of Dr. Frank W. Lane, director of X-ray therapy at Mary Hitchcock Hospital in Hanover, N. H., when he addressed **Twin States** members in January. Walter Posner was awarded first prize in their membership drive.

OKLAHOMA CITY—A smiling group of chapter and city dignitaries shown at the January meeting are seated, from left: J. R. McVay, secretary; William Gill, Jr., city manager; and W. B. Haney, chairman. Standing are committeemen, Leon Lamson, L. J. Anderson, and C. R. Baker.

Ross Robinson, representing Standard Oil Co., presented "Cutting Fluids for Nonferrous Materials" at a recent **Wichita** meeting. His talk touched on percentage of mixtures, rancidity controls, and disposal after use, and mentioned the types for use in "extreme pressure" conditions.

Williamsport chapter visited the Steelex Corp., a Swedish company manufacturing stainless steel articles. A demonstration of roll forming and polishing was seen after an introductory talk by Plant Manager Birger Engzell. Members heard the story of "Satellites and Guided Missiles" from Mr. Williams of the Martin Co. at an earlier joint meeting with SAE.

The first panel-type program attempted by **Windsor** proved successful at the chapter's January meeting, when die casting was the subject. Panel members were T. Campbell, Dominion Die Casting; D. Fry, Ontario Steel Products; J. Bulmer and G. Clark, Schultz Die Casting; and R. McLean, Aluminum Co. of Canada. The chapter's February meeting, sponsored by Wesson Tool Co. of Canada, featured T. J. Smith, metallurgist of the company's carbide division, speaking on carbide manufacture.

Worcester members visited The Bellows Co.'s "Controlled-Air-Power Devices" display at their New England Production Ingenuity Show as a February function. Members of **Springfield, Mass.** and **Little Rhody** also attended, and heard William C. Richards, vice president of Bellows, speak on "The Tool Engineer and Automation." An earlier meeting at Worcester featured Speaker D. T. Peden, vice president of research at Micromatic Hone Corp., explaining the microhoning process.

Optical Techniques Shown at Lima Meeting

The new field of "optical tooling" was laid open to Lima chapter members and guests on January 17. M. C. Anderson, representing the Charles Bruning Co., Chicago, distributor of optical instruments, described the new technique which uses precision optical instruments in leveling, aligning and measuring to within a thousandth of an inch accuracy. The method originated in the aircraft industry, where close adherence to specifications is of primary importance, Mr. Anderson revealed. His talk was accompanied by a movie.

This meeting was designated as Baldwin-Lima-Hamilton night. A film, "On the Move," showing the company's equipment in use, was accompanied by a brief sketch of the growth of Baldwin-Lima-Hamilton by Perry Percy, sales engineer. *—George Johoske*

DAYTON—Examining sample parts made by Amplex are Speaker Glikes; Carl Epperly, second vice chairman; George Brandt, first vice chairman; Ted Dimke, Chrysler representative; Francis J. Heberling, chairman. —*R. A. Miller*

San Antonio Chapter Announces New Officers

February's meeting of the San Antonio membership saw the following men elected to direct chapter activities for 1957-58: A. A. Hansen, chairman; G. E. Spangler, Jr., first vice chairman; C. H. Chiodo, second vice chairman; W. A. Lang, secretary; C. W. Reed, treasurer; and J. B. Frix, national delegate. The film, "Moody's-Religion in Science" completed the meeting.

The chapter's program and education committees combined their efforts to bring an interesting, two-part technical session before the members in January. The first topic discussed was welding procedures, techniques, equipment, materials and supplies, and was presented by Richard A. Pierce of Reliance Engineering and Mfg. Corp. The second discussion covered a comparison of cast iron and ductible iron, with reapect to welding, testing processes, and impact and bend capabilities. —*S. G. Gower*

Buffalo-Niagara Holds Annual Lockport Meeting

Buffalo-Niagara Frontier held its annual Lockport meeting at the Tuscarora Club. Ninety people attended the meeting which included a buffet dinner.

Edward Dye of the Cornell Aeronautical Labs., Inc., presented a talk on "Auto Crash Safety." Cornell labs recently conducted an extensive research program on the subject.

The nominating committee of the 450-member chapter presented its slate of nominees for the coming year: Russell Fitch, chairman; J. Robert Fisgus, first vice chairman; Arthur Thormahlen, second vice chairman; James W. Bowler, secretary; and R. C. Klas, treasurer. Robert Slate as the present chairman was nominated for national delegate and the incoming chairman, alternate. —*George Gasior*

LORAIN COUNTY—Shown at left, Carl Mourning, first vice chairman, presents a year's subscription to THE TOOL ENGINEER and a copy of the *Tool Engineers Handbook* to John Rebenack, Elyria librarian. Past President Dr. H. B. Osborn, Jr., speaker of the evening, looks on as Eric Nord, works manager of U. S. Automatic Corp., receives from Henry Bothe, chapter chairman, one of three affiliate member plaques awarded to area industrial leaders.

SCHENECTADY—P. R. Visser, chapter secretary, discusses the use of plastics as tools with the evening's speaker, R. W. Sullivan, senior engineer at G.E.

Elmira To Award Student Drawing Winners

Elmira chapter plans to hear Past President H. B. Osborn, Jr., who will speak on "Tooling for Induction Heating" on April 8.

Other highlights of the program will be the presentation of awards to winners of Elmira's Student Drawing Contest. These awards consist of various tools useful to student designers and a certificate of achievement.

Due to the outstanding work Elmira members have done in contacting schools and in choosing a good subject for the participants to draw, over 50 students, the highest number of entries to date, entered the contest.

—*Donald Wilcox*

Saginaw Valley Hears Discussion on Bearings

Timken Roller Bearing Co.'s chief industrial engineer, Sam Weckstein, spoke to 81 members and guests of the Saginaw Valley chapter in Frankenmuth, Mich., recently. His subject, "The Selection, Installation, and Maintenance of Bearings," was made particularly interesting by anecdotes from his recent trip to Western European steel mills in France, Austria and Germany. During the question period following the talk, the subject was broadened to include the aspects of bearing lubrication and application. Timken's district sales manager, Mr. McKinney, distributed engineering reference material to those interested. —*Edward A. Reed*

Coming Meetings

On-Campus Conferences

PURDUE UNIVERSITY—April 28, West Lafayette, Ind. Theme, "What's New in Tooling?"

STATE UNIVERSITY OF IOWA—April 13, Iowa City. Theme, "New Processes and Developments in Industry."

Regional

NEW ENGLAND REGIONAL CONFERENCE, May 3, Sheraton Kimball Hotel, Springfield, Mass. Plant tours and technical sessions.

Chapter

ANN ARBOR AREA—April 17, 6:30 p.m., no meal. Tour, G. M. Motors Proving Grounds, Milford, Mich. ASTE members only.

CALIFORNIA STATE POLYTECHNIC COLLEGE—April 3, 7:30 p.m., Cal-Poly AE 123. Malcolm F. Judkins, manager, New Products Div., Firth Sterling, Inc. on "Industrial Nuclear Power."

COLUMBUS—April 10, 6:30 p.m., at the Athletic Club. Burnham Finney, editor, American Machinist Magazine, on "What Industry Asks of Our Schools." Annual Executive Night.

DETROIT—Regular Section: April 18. 6:30 p.m. dinner at E.S.D. Technical meeting, 8 p.m. Girard H. Appell on "Cold Forming Process for Metals." Carbide Section: Tour of Cincinnati Milling Machine Co., April 27. Chartered train 10:45 p.m. April 26. Education Section: April 25, 8 p.m. F. V. Stoffer, The Bellows Co., on "Controlled Air Power."

EAST TEXAS—April 11, 7:30 p.m., Skyway Restaurant in Gregg County Airport. Sales representative of Norton Grinding Wheel Co. on "Grinding for Production."

ERIE—April 9, 6:45 p.m., social hour at 6:15 and dinner at Waite's Tavern, 5735 E. Lake Rd., followed by plant tour, Hammermill Paper Co., 8 p.m.

GRAND RIVER VALLEY—April 5, 8 p.m., Shep's Hall, Galt, Ont. Three speakers, Dow Chemical Co. on "Tooling for Plastics."

HAMILTON DISTRICT—April 12, 6:30 p.m., Brant Hotel, Brantford. E. H. Despard, sales manager, Canadian General Electric Co., Ltd., on "Carbide Tooling."

INDIANAPOLIS—April 4, 8 p.m., Antlers Hotel. J. Y. Riedel, Bethlehem Steel, "Improving Production from Dies and Tools."

KEYSTONE—April 15, Castle Restaurant, Scranton. DoAll Story of Measurement. Joint meeting of American Society Quality Control and the Anthracite Club.

LEHIGH VALLEY—April 12, 6:30 dinner. 8 p.m., technical, Hotel Traylor, Allentown, Pa. Miss B. B. Small, department chief, Quality Control and Development Engineering Dept., Western Electric, Allentown plant. Special joint meeting ASQC.

LONDON-ST. THOMAS—April 26, Town & Country Club. Annual Ladies Night.

LONG BEACH—April 10, 7:30 p.m., The Long Beach Petroleum Club. George T. Fraser, western sales manager, Rem-Cru Titanium Inc., "Titanium and Its Application."

LONG ISLAND—April 9, 8:30 p.m., Garden City Hotel. C. G. Schelly, managing director, Wilkie Foundation, The DoAll Co., "The Story of Measurement."

LORAIN COUNTY—May 1, 6:30 p.m., Gardner Inn, Elyria.

MANSFIELD—April 18, 6:30 p.m. Mr. Osborn, district representative, Heller Tool Co., "The History of Files." Color film on "Files and How To Use Them."

MERRIMAC VALLEY—April 4, Speech on "Industrial Electronics."

MID-HUDSON—April 9, 6:30 p.m. Nelson House. S. W. Taylor, American Standards Association, "American Standards for Tools and Quality Control." Host at annual joint meeting with ASQC. Coffee speaker, Leonard Freeman, B. F. Goodrich Co., "Relationship of Quality Control to Mass Production Techniques."

MILWAUKEE — April 11, 6:30 p.m., American Serbian Memorial Hall. Messrs. John L. McCoy and S. Toohey, Sheffield Gage Co., "Machining the Unmachinable by Ultrasonics." Movie by I. H. C., "Man with a Thousand Hands."

MUNCIE—No April meeting.

NEW HAVEN—April 11, 3 p.m. Visit Eli Whitney Technical School.

NIAGARA DISTRICT—April 12, 7 p.m., Park Hotel. First annual ladies' night, dancing and musical entertainment.

NORTHWESTERN PENNSYLVANIA — April 4, 6:30 p.m., Elks' Club. Daniel Lundquist, eng. supervisor, Marlin-Rockwell, "Ball and Roller Bearings —Design, Manufacture and Application."

OKLAHOMA CITY—April 9, 6:30 p.m., Green Room, Oklahoma City University. George C. Roberts, plant engineer, Tinker Field, "Gem Grinding."

OTTAWA VALLEY—April 9, 8 p.m., National Museum. V. E. Lysaght, sales manager, Wilson Mechanical Instrument Div., American Chain & Cable Co., "Hardness Testing." Also slides.

OZARK—April 18, 8 p.m., Roberts Cafeteria, Sixth & Joplin. Charles Brigner, tool engineer, Valerom Corp., "Throw-Away Type Tooling."

PHILADELPHIA—April 18, 7:30 p.m., Engineers Club of Philadelphia. William Busch, Lodge & Shipley Co.; G. L. Beatty, Cincinnati Milling & Grinding Co., "New Concepts in Metal Forming."

PITTSBURGH—April 5, 6:30 p.m., Gateway Plaza. William M. Aiken, vice president, Methods Engineering Council, "Motion Time Methods in Tool Engineering."

PORTLAND, ME.—April 5, 7 p.m., Falmouth Hotel. R. G. Kronbach, who is sales engineer, Elox Corp. of Mich., "Electrical Discharge Machining."

PORTLAND, ORE.—April 18, 7 p.m., Burns Restaurant. Walter L. Brenneke, Mixermobile Corp., "Chapter's Background and History to 1951." Prof. Russell Williamson, industrial engineer at D.S.C., Corvallis, "Education of the Tool Engineer, Past, Present and Future." Fred D. Mondin, general superintendent, Machine Shops, Wisco, "Progress of Chapter from 1951 to Present, and Some Potential Possibilities for Future." Reports of national delegates of convention activities.

POTOMAC—April 4, 8:30 p.m., The Roger Smith Hotel, interior auditorium. C. G. Schelly, The DoAll Co., "The Story of Measurement."

RIVERSIDE—April 9, 7 p.m., Mike's Cafe, 3330 Market St. Two representatives, Richfield Oil Corp., L. A. Div., "How an Oil Field Works." Film and discussion.

ROCHESTER—April 1. Norman Olsen and Mark Ziegler, Aluminum Co. of America, "Aluminum Impact Extrusions."

ROCKFORD—April 11, 7 p.m., Lafayette Hotel. Raymond J. Severson, assistant general sales manager, Ampco Metals, Inc., "Machinability and Uses of Bronze Alloys." April 12, field trip through Argonne Laboratories.

SAGINAW VALLEY—April 18, Frankenmuth. Program, "Nuclear Energy."

ST. LOUIS—April 4, 7 p.m., 4300 Goodfellow Blvd. Plant tour through United States Defense Corp.

SAN FERNANDO VALLEY—April 3, Atomics International Div. of North American, presents "Construction of Nuclear Power Plant." "Fabrication of Sodium Reactor."

SAN GABRIEL VALLEY—April 4, 8:30 p.m., Rainbow Angling Club, Azusa. "Metals for Atomic Energy."

SCHUYLKILL VALLEY—April 9, 6:30 p.m., Berkshire Hotel (tentative). William W. Schug, vice president, V. & O. Press Co., Div. of Emhart Mfg. Co., "High-Speed Blanking and Piercing Dies" and "Dial-Feed Manufacturing and Assembling Operations."

TOLEDO—April 10, "Tube Bending."

TORONTO—April 3, 7:30 p.m., Oak Room, Union Station. Special Educational and Students' Night. Two students from Ryerson Institute of Technology will present two theses, self-prepared. Other speakers will discuss "Education for the Tool Engineer."

TRENTON-DELAWARE VALLEY—April 15, 6:30 p.m., Hotel Hildebrecht. Donald E. Oberg, general manager, Oberg Mfg. Co., "Carbide Punch Press Dies."

TRI-CITIES—April 10, plant tour of The Alcoa Plant installation.

TUCSON—April 9, W. B. Cornner, Rezolin, Inc., "Plastic Tooling."

TWIN CITIES—April 3, 6 p.m., Tonka Toys, Mound, Minn. Dinner at The Casino. Tour of Tonka Toys follows.

TWIN STATES—April 10, Past Chairmen's Night. Thomas F. Burke, Dale Carnegie Courses, "Selling Your Ideas."

UTAH STATE AGRICULTURAL COLLEGE—April 4, 4 p.m. Mechanical Arts Bldg., USAC Campus. Regular business meeting and movie.

WICHITA—April 10, 6:30 p.m., Wolf's Cafeteria. Program to be announced.

WINDSOR—April 26, 6:30 p.m., dinner, Elmwood Casino. Ladies night.

WORCESTER—April 2, 7 p.m., Putnam & Thurston's Restaurant. J. R. Ballinger, manager, Systems Application Div., Bendix Research Laboratories; "Digitally Controlled 3-Dimensional Milling and Die-Sinking Machining."

members on the MOVE

James B. Wilkie, Hartford, has been appointed to the executive board of the Dimensional Standards and Metrology Div. of the American Ordnance Assn. of Washington, D. C.

Ernest S. Griswold, Hartford, has been appointed chief product engineer of the cutting tool division of Pratt & Whitney Co., Inc.

Harry E. Eriksen, Saginaw Valley, has been promoted to plant manager of the Kokomo, Ind., Die Casting plant of Chrysler Corp.

Charles R. Staub, Detroit, former chief engineer, Michigan Tool Co., has retired.

C. R. Morgan, Twin States, consulting engineer for the Cone Automatic Machine Co., has retired and is now available for consultation work applying to multispindle automatic screw machines, using carbides and other tool setups on this equipment.

Charles R. Garfield, Pittsburgh, has been appointed abrasive engineer for Norton Co.

David M. Gaskill, Cleveland, has been appointed manager of industrial equipment sales for Brush Electronics Co., a division of Clevite Corp.

Curtis D. Cummings, Fairfield County, has been appointed sales manager of the Campbell Machine Div., American Chain & Cable Co.

E. E. Lull, Syracuse, has become assistant product manager, tool steel sales, for Crucible Steel Co. of America.

Russell V. Ringquist, Rockford, has been named sales manager of the Carbide Div., Besly-Welles Corp.

Melvin L. Weinberg, Detroit, has been named vice president in charge of sales and service, Putnam Tool Co.

E. A. Sundstrom, Philadelphia, is now district manager, Chicago sales office, The Bullard Co.

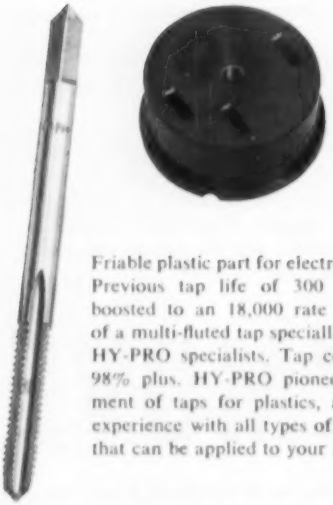
HY-PRO specialists deliver

savings as high as 98%

with taps of special design

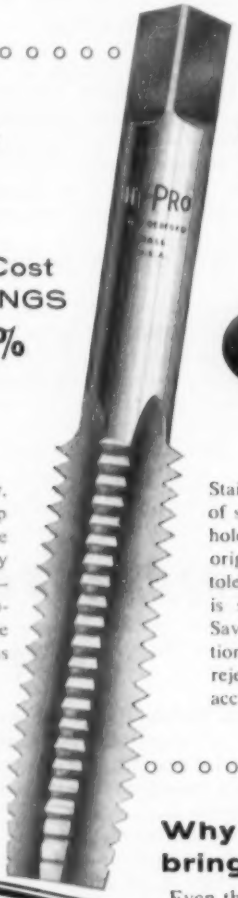
While HY-PRO standard taps meet most production needs, you can rely on HY-PRO specialists to tell you when it will pay you to use a tap of special design. You can also rely on the design they develop to deliver maximum savings, — in tap expense, in production time. The proof is in the records of hundreds of jobs like the two described below. Why not let HY-PRO engineering ability and experience uncover comparable savings for you?

from 300 to 18,000 holes per tap...



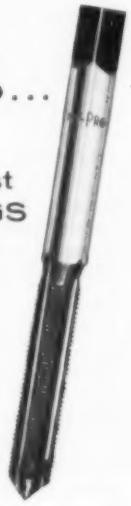
Tap Cost SAVINGS **98%**

Friable plastic part for electronic industry. Previous tap life of 300 holes-per-tap boosted to an 18,000 rate with the use of a multi-fluted tap specially designed by HY-PRO specialists. Tap cost saving — 98% plus. HY-PRO pioneered development of taps for plastics, and has wide experience with all types of compositions that can be applied to your advantage.



from 100 to 800 holes per tap...

Tap Cost SAVINGS **88%**



Stainless steel aircraft part. HY-PRO tap of special design raised tap life from 100 holes-per-tap to 800. Threading with the originial tap was rough, varying over tolerance. With the HY-PRO special, it is smooth, clean, consistently Class 3. Savings in tap cost — 88%; plus an additional big saving gained by eliminating rejects previously scrapped because of inaccurate threading.

HY-PRO

REG. U. S. PAT. OFF.

The Tap Engineering Specialists

Why "special" tap development brings you better "standards"

Even though you never need "specials", you benefit by HY-PRO leadership in special tap design. The intensive research and testing involved is all reflected in constant improvement of HY-PRO standard taps. It costs nothing to consult HY-PRO specialists, and they can often point out opportunities for substantial savings, even in tapping operations you've considered satisfactory. What's your problem? Write: Dept. C.

ASK FOR STOCK LIST OF SPECIAL TAPS AVAILABLE FOR IMMEDIATE DELIVERY

CALL YOUR LOCAL **HY-PRO DISTRIBUTOR** FOR STANDARD TAPS FROM STOCK
HY-PRO TOOL COMPANY · NEW BEDFORD, MASS., U. S. A.

PROGRESS IN PRODUCTION

NUMERICAL CONTROL METHOD USES DECIMAL SYSTEM

Complete automation of machine tools such as jig borers, grinders and rotary tables is possibly a step nearer with the introduction of a somewhat different system of numerical control by engineers of Pratt & Whitney Co., Inc. Automatic positioning is accurate within 0.0001 in. or 5 sec. of arc. With the innovation, machine tools that formerly could be used only as toolroom equipment can be made available for volume production purposes.

The new system differs in that it is based on the common decimal system (decimal of an inch and decimal of a degree of arc). Dimensions shown on a blueprint are punched on tape as easily as numbers are tabulated on an adding machine. Mathematical conversions are unnecessary.

All blueprint data needed for locating, indexing, boring and grinding is stored on punched tape and translated directly into mechanical action by the machine.

The automatic programming which numerical control provides, makes high precision of jig borers, precision hole grinders and rotary tables available for production work. Easily and economically prepared punched tapes take the place of complex fixturing. Thus automatic programming and operation become practical for short production runs and for machining of one or two pieces with multiple holes with minimum operator fatigue.

Operator training periods can be substantially reduced because high skill needed for precision work is built into the system.

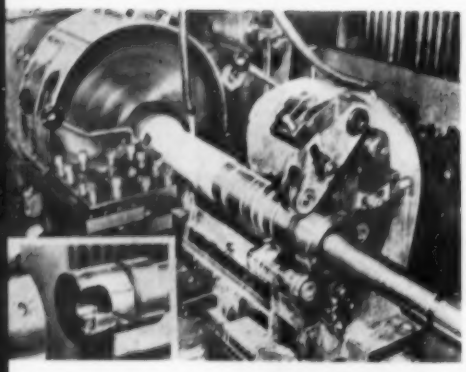
Vertical precision hole grinder built for Ford Motor Co.'s Aircraft Engine Div. Units, as arranged from left to right, include: control cabinet, hole grinder, control panel and cabinet containing tape into which digital information has been punched to automatically and position workpiece.

TOOLING SETUP SAVES TIME AND COST

Production savings of about $30,000 a year are being netted by Baker Oil Tools Inc. because of the tooling setup for gun drilling retainer production packer bodies for oil wells on a special lathe engineered for cemented carbide cutting tools. Approximately half the savings is in honing costs. At the same time, machining time was reduced more than 25 percent; it is estimated that the machine, a Gisholt 3L turret lathe with a bed 30 in. longer than standard, will pay for itself in reduced costs in the first 15 months of operation.

The packers, installed at depths exceeding three miles, hold pressures of about 10,000 psi under temperatures in excess of 300 F. They are used to seal off small diameter tubing which extends to the surface, from larger diameter casings that also may extend to the surface. High pressures are confined by the packer from the producing zone to the smaller size tubing where it can be controlled. At the same time it protects the casing.

The packer body, of centrifugal cast iron, is a cylinder that must have a smooth bore. Special seals, made up as part of the tubing when positioned in



Two operations are performed simultaneously on the oil well production packer body. A Carboloy grade 883 carbide cutting tool is about to complete finishing pass at left while at right the arm of gun drilling head is partly inserted in work. Closeup of gun drilling head and position of carbide cutting tool is shown in inset.

the bore, seal off the tubing in the packer bore in the same manner that piston rings seal a piston off in a cylinder bore.

With the modern setup, all turning requirements on each packer body are completed in two main operations combining several machining steps previously done separately. Once the machine is set up for a production run, it need only be checked periodically for several months.

The part involved is 4 in. in diameter and 31 in. long, made of 30,000 tensile, centrifugally cast iron with heavy scale. Once the casting is chucked in the lathe, the entire piece is rough and finish machined, both inside and out, except for approximately 5 in. on one end needed for chucking. Operation includes roughing and finishing the outside, cutting one 8-pitch V-thread, one 16-pitch buttress thread, and gun drilling and burnishing the bore the entire length of the part.

Threading, finishing and gun drilling operations are done simultaneously. While gun drilling, the outside diameter of the part is finish machined and a 16-pitch buttress thread is incorporated in part of the outside diameter. Threading, covering a length of about 8 in., is done with carbide tools mounted on a rotating indexable mechanical holder which holds other carbide tools for previous finishing operations. Since the work is rotating for gun drilling, the same speed of 242 rpm is used for finishing and to generate the 0.015-in. deep buttress threads. After gun drilling, a roller burnishing tool running about 158 fpm is pushed through the bore to size the hole and provide proper finish.

SPECIAL EQUIPMENT SPEEDS HONING JOB

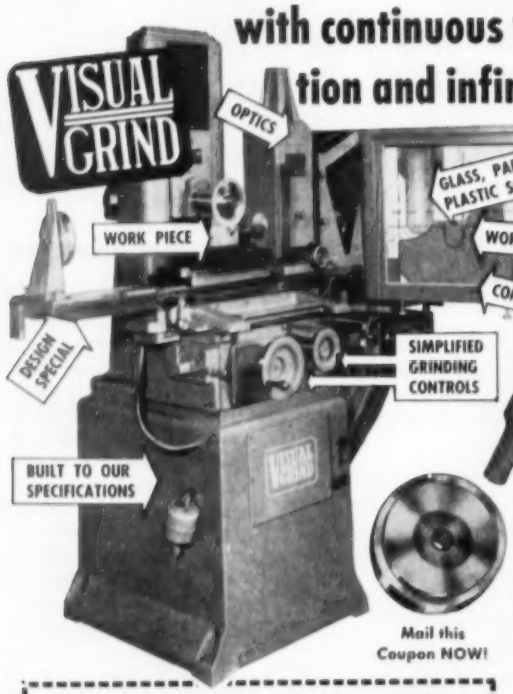
In the manufacturing of refrigeration compressors Tecumseh Products Co. employs 18 Microhoning machines to process cylinder, cross and piston-pin bores and other vital surfaces. The twin cylinder crankcase is a typical application of the setup.

Two piston bores in each crankcase are located opposite each other when viewed vertically, but lie in two different horizontal planes. Although the crankcases are similar in design, the bores come in four diameter sizes—1.312, 1.315, 1.500 and 1.625 in.—and are approximately 2 in. long.

To permit the two bores to be honed simultaneously, horizontal machines with two opposing spindles are used. By utilizing two fixtures on a rotary indexing table, one crankcase is honed while another is being loaded.

For a run of crankcases of different piston bore diameters, only the tools and gage rings are changed. This switchover takes about five minutes. Including fixture indexing time, the honing cycle is approximately 18 sec.

TOP FIRMS SHOW
PROVED SAVINGS
UP TO 75% in Set-up and Grinding Time
with continuous work inspection and infinite precision



SIMPLIFIED OPERATION

When working with TUNGSTEN CARBIDE, STAINLESS STEEL, STELLITE or TOOL STEELS, VISUAL GRIND permits a semi-skilled operator to grind precision pieces without continued checking with the comparator. Automatic inspection is accomplished with the built in optical comparator.

Visit our plant . . . let us show you how VISUAL GRIND will speed production — cut costs.

Mail this Coupon NOW!

CLEVELAND GRINDING MACH.
1680 Eddy Road Cleveland 12, Ohio

Gentlemen:

☐ Please have your representative call at our plant. The most convenient time would be (week) .....

☐ Phone for appointment

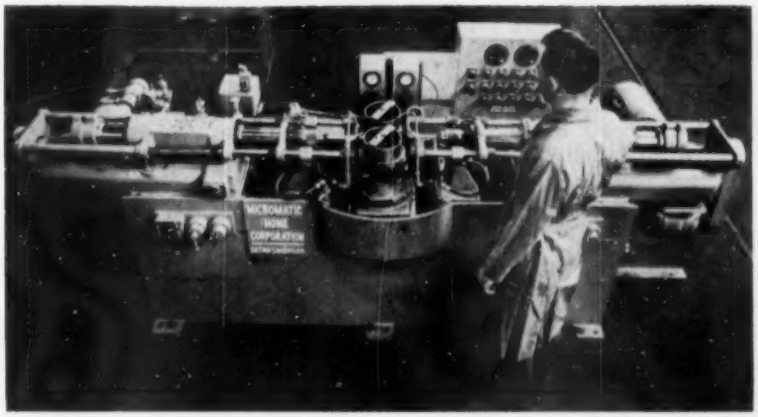
☐ Please send us complete information on the new VISUAL GRIND.

NAME ..... TITLE .....

COMPANY .....

ADDRESS .....

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-158



Accuracy of the selective-fitted piston—to a tolerance of 0.0001 in.—results in a running seal that requires no rings to prevent gas leakage.

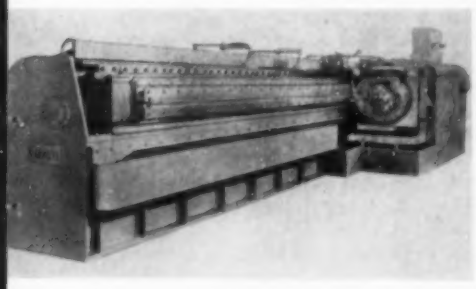
Stock removal on the cast iron workpiece is from 0.0007 to 0.001 in. Finish is 10 microinches, and tolerances are 0.0003 in., diametric, 0.00015 in, roundness, and 0.00015 in. for taper.

LARGEST BROACHING UNIT TAKES GIANT CUTS

Pine tree holding slots in the periphery of gas turbine wheels are broached by a 240-in. stroke electro-mechanical drive horizontal broaching machine. The new giant was developed by The Lapointe Machine Tool Co.

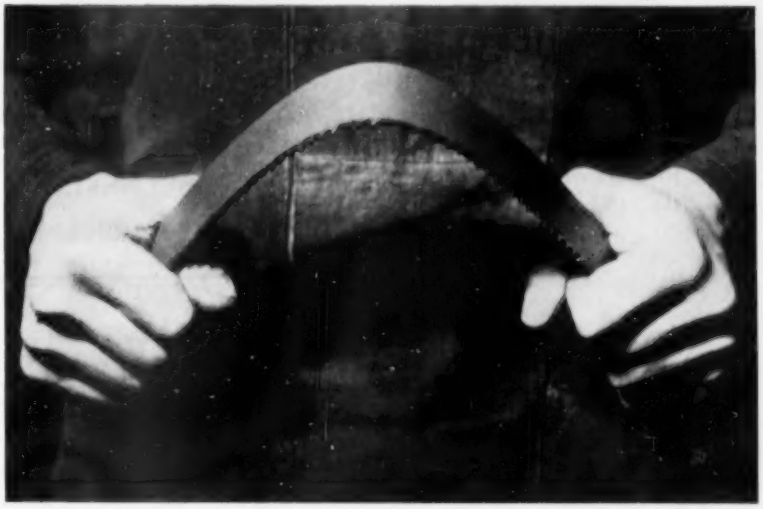
Considered the world's largest broaching machine, the 50-ft unit broaches a slot 1.6 in. deep and up to 5 in. rim thickness removing 150 lb of metal per wheel. Actual broaching time per big 90-slot wheel is 2⅓ hours. The slot is broached in two passes. Length of the broach cutting section totals 450 in. By changing broaching tools and using adapter plates on the indexing fixture, each turbine and compressor wheel can be broached on the same machine.

Variation in diameter of wheel broached on the indexing fixture is from 40 to 80 in., and the number of slots goes from 30 to 150. Index is held to 0.0002 in. of true position. The broached form is held to within a tolerance of 0.0003 in.



AIRCRAFT FORMING METHOD CUTS TIME AND COST

Extensive savings were realized by Chance Vought Aircraft through use of a universal joggling attachment developed by its engineers. Job involved was the manufacture of a series of Z-section frames for the F8U-1 Crusader. Some of the heavy aluminum frames, which are brake formed and extruded, have return flanges and require joggles in one flange only. Accurate, well defined joggles were produced during stretch forming. Forming joggles while stretch tension is held on the part avoids contour deformation common when done as a second operation. Previously extensive



THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge.

With a MARVEL Blade, you can cut any material—from the free machining steels to the toughest alloys . . . fast, accurately and economically. You can tension a MARVEL Blade from 200% to 300% tauter than any ordinary blade, permitting much higher speeds and heavier feeds without deflection or breakage.

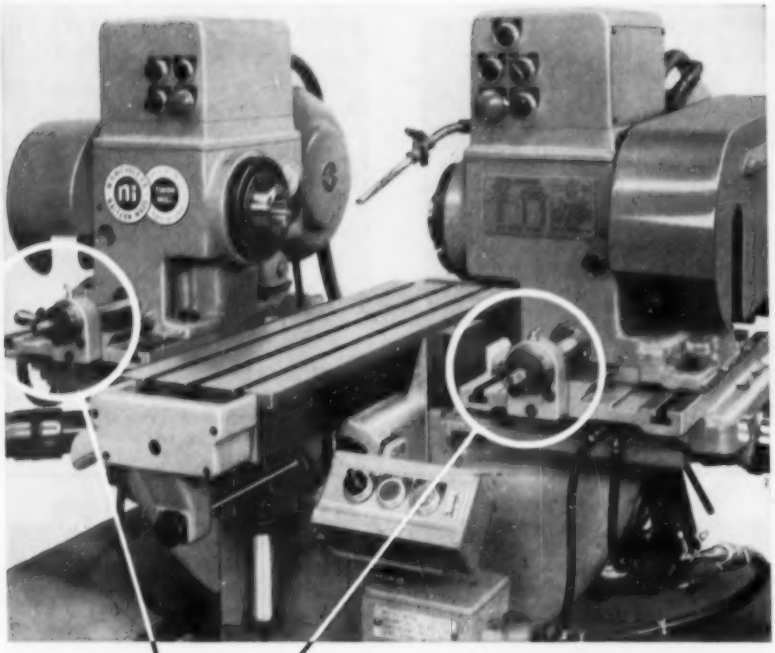
Like all good things, attempted copies of the MARVEL Blade have been numerous, but its performance has been *unequalled* by any of the imitators. Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

Write for latest cutting tool Bulletin and the name of your nearest MARVEL *Distributor.* FB-1029

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 W. Bloomingdale Ave., CHICAGO 39, U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-159



NICHOLS TWIN MILL...
SOMETHING NEW HAS BEEN ADDED

Now, the Nichols Twin Mill offers dovetail slides with micro-feed screws for *longitudinal* adjustment of milling heads, as well as transverse and vertical screw adjustments. With this new feature, the Nichols Twin Mill provides SIX-WAY ADJUSTABILITY FOR EACH MILLING HEAD IN SECONDS!

Adaptable for long or short-run jobs. The scope of Nichols Twin Mill utility is limited only by the imagination of the user.

THINK: Two geared milling heads—each completely independent with independent drives, push button controlled. Wide range of spindle speeds—55 to 2050 R.P.M. Vertical Head available for either or both spindles. Automatic Table cycle with rapid approach, hydraulic-controlled variable cutting feed and rapid return.

THIS MEANS: The Milling Heads may be directly opposed or offset longitudinally, vertically or transversally. Ferrous or non-ferrous materials can be milled with HSS or carbide tipped cutters. IT ALL ADDS UP to top production with fine finish while TOLERANCES TO TENTHS are maintained with ease.

Complex light milling jobs can be milled faster and more economically with the Nichols Twin Mill. "Two Heads are better than one—for sure".

WRITE OR PHONE FOR FULL DETAILS—CATALOG.

Manufactured by W. H. NICHOLS COMPANY

National Distributors

THE ROBERT E. MORRIS COMPANY

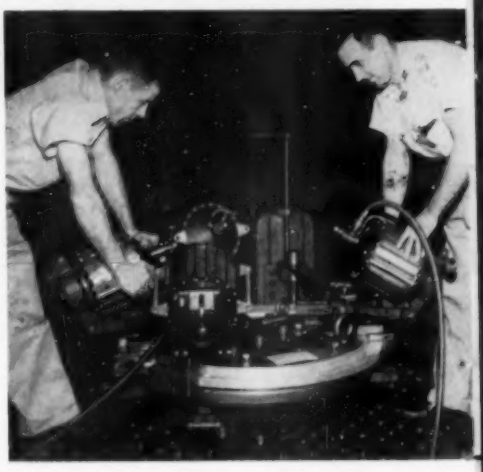
5006 FARMINGTON AVE. • WEST HARTFORD 7, CONN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-4-160

hand finishing was required to correct deformation.

The attachment develops a thrust of 50,000 lb., but requires a lifting force of only 24 lb. to index from locked to open position. It may be used wherever shop air pressure is available and is adaptable to any stretch press without alteration.

Provision for the attachment is a 3½ in. diameter hole in the stretch die located approximately at the center of the joggle and 3 to 8 in. inside the die contour. Time required for setup and adjustment normally is less than a minute per attachment. Number of attachments applied is limited only by die length. At Chance Vought, five attachments have been used simultaneously on one die.



Four joggle cylinders are applied to a die; they are shown in open position for loading and unloading parts.

License for manufacture of the attachments has been let to the Cyril Bath Co.

INTERNAL TESTING SOLVES INSPECTION PROBLEM

Correct determination of the microhardness of the interior surfaces of chrome plated metal castings is no longer a problem thanks to typical engineering ingenuity. Time, corrosion and metal fatigue affect the interiors of such castings, particularly in heavy-duty and high pressure applications where they are called upon to carry viscous chemical, toxic liquids, wastes etc. Adequate inspection techniques are particularly important to prevent eventual failure in service.

Alco Products, Inc. adapted a standard Type Mo Tukon tester made by Wilson Mechanical Instrument Div. of American Chain & Cable Co., to the job. The tester is mechanically operated

M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

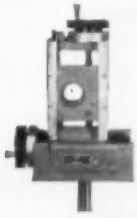
with new Gaertner Coordinate Cathetometers

These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

M1236-46— Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.



M1236-22— Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

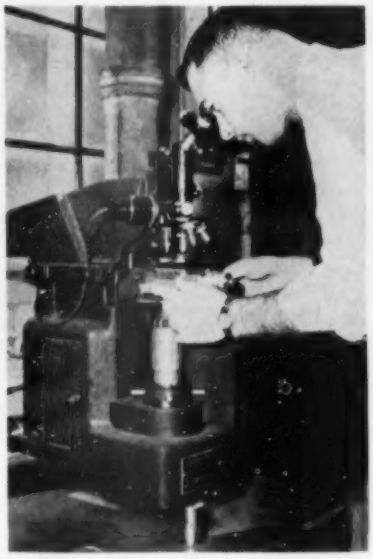
Write for Bulletin 188-53

The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

INDICATE A-4-161-1

and load is applied under dash-pot control, speed of which may be varied from less than 0.04 ipm to as fast as testing permits without influencing the results. Rate of application and duration of applied load, consequently, are under constant supervision and direc-



The microhardness tester is used to check a metal sample.

tion of the operator. Loads from 1 to 1,000 grams can be applied to any and all specimens under observation. Focusing the impression under the microscope is accomplished with the unit's elevating mechanism.

ELECTROLYTIC GRINDING SPEEDS TOOL MAKING

In manufacturing a line of solid carbide end mills, the Abrasives Div. of Elgin National Watch Co. is making use of a special electrolytic grinding process. Important advantage of the technique is the extensive reduction in grinding heat in the tool manufacturing stage. As a consequence, the mills are not subjected to heat stresses ordinarily met in conventional processes and there is no heat check damage.

Metal stock is removed by a deplating or electrochemical action in conjunction with a special diamond wheel used largely to shape the cut of the work. The diamond wheel receives a negative electrical charge while the carbide tool blank is positively charged during stock removal.

Cutting is accomplished with a special electrolyte which is fed to the work with a wax-impregnated coolant. The wheel guides flute etching of the carbide tool blank with little heat generation.

WITH WOODWORTH CHUCKING EQUIPMENT

Our tough looking character who is holding the smiling baby clearly demonstrates one fact: whenever you are holding *anything* it should be secured with gentle firmness. And this is so true when considering chucking equipment.

Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged, accurate and dependable chucks for precision machining in America.

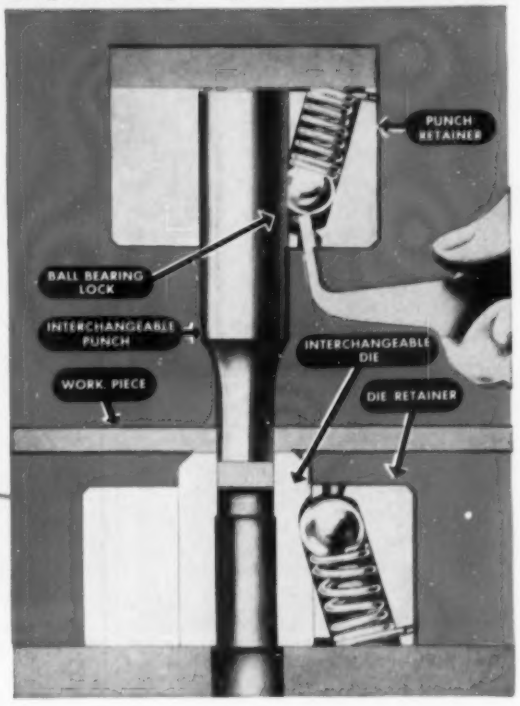
We invite your inspection and consideration of N. A. Woodworth products. There is a Woodworth Sales Representative in your area and a letter to the N. A. Woodworth Company will place him promptly at your service.

"Accuracy you can trust"

WOODWORTH
1300 East Nine Mile Road
Detroit 20, Michigan

INDICATE A-4-161-2

HOW R-B PUNCHES OPERATE



All R-B retainers are equipped with spring-loaded locking balls which engage the recessed portion of R-B punches and die buttons. With a simple push and a twist, R-B standardized punches and die buttons are locked in their retainers . . . they are also instantly removed. R-B punches and die buttons are always accurately aligned—no additional keying is required.

No other manufacturer of punches and die buttons can offer you the amount of successful application experience and the scope of knowledge that is available from the R-B engineering staff for:

- ★ Cutting Your Production Costs
- ★ Reducing Die Designing Time
- ★ Increasing Productivity of Presses
- ★ Supplying Answers to Piercing Problems
- ★ Saving Die Construction Time
- ★ Complete Standardization of Press Tooling

For Additional Information or Engineering Service, Write to:

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 84 • 2840 CAPITOL AVENUE • DETROIT 39, MICHIGAN

TOOLS of today

Cold Forming Machine

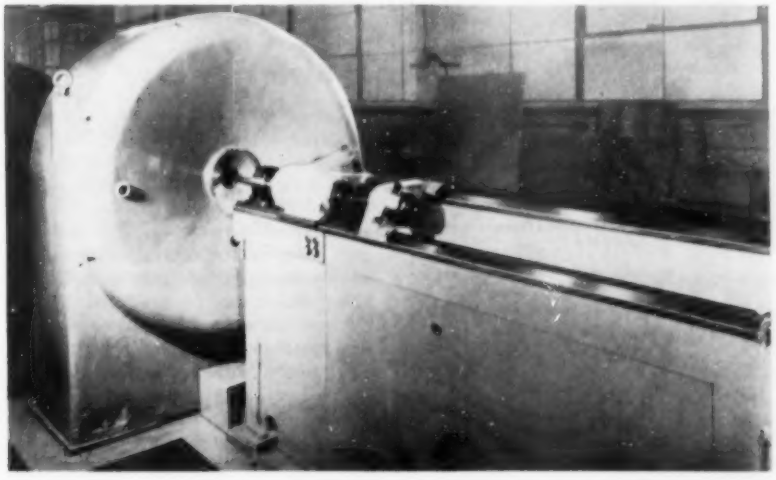
This machine is designed for cold forming metals by the Appel cold forming process which accomplishes cold forming through kneading or plasticizing materials at temperatures below 150 deg.

For high-speed precision forging, this eccentric-operated prism machine provides radial stroke with radial-acting balanced forces, a time-controlled kneading of the material, and controlled movement of hammer elements to avoid rebounding.

The No. 4 Fellows-Appel cold forming machine consists of a forging unit and feeding unit joined together. The work is fed into the forging unit where the forging dies are simultaneously forced onto the work in a direction radial to its center. Rate of feed is dependent upon the amount of deformation per stroke; number of strokes; feed and rate of rotation of the work are adjustable. Selection of these elements is determined by the type and the physical properties of the material being formed, its dimensions, the required deformation and the shape of the deforming section of the tool set. Changes from one size of work to another can be easily and quickly accomplished.

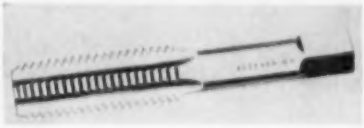
Surface finish produced is 8-10 microinches, although a finish of somewhat better than 2 microinches can be obtained. Both ferrous and nonferrous materials can be cold formed by this process as long as the materials are ductile. Various types of carbon and alloy steels, as well as brass, bronze, aluminum, titanium, and stainless steels, have been formed.

Exclusive license to manufacture for the U.S. and Canada has been granted The Fellows Gear Shaper Co., Springfield, Vt. **T-4-1631**



Tap

This tap, called "elektra Lube" is coated with a thin ductile deposit which acts as a permanent lubricant during tapping process. The coating is not subject to chipping or peeling. Under working pressures, the deposit imbeds itself into microscopic pores of the



ground tap, resulting in a smooth burnished surface which becomes an integral part of the tap.

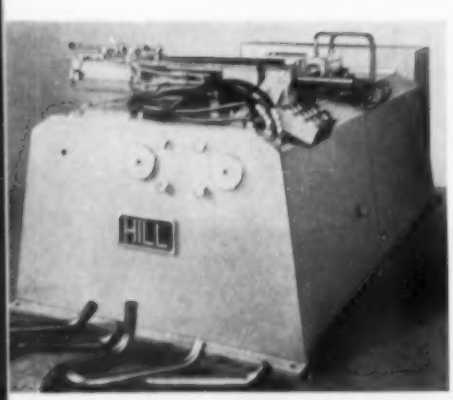
The tap, thus lubricated, cuts freely. Tests indicate as much as 25 percent reduction in torque. Material has little tendency to stick to the cutting surfaces of the tap.

Sossner Tap & Tool Corp., Lynbrook, N.Y. **T-4-1632**

Press Bending Machine

Ferrous or nonferrous tubular parts can be given two or more bends so that varying angles are in accurate relationship by this press type bending machine. The compact design assures accuracy of bend relationships by clamping one end of the tubular part and holding it stationary while a bend is produced on the other end by a hydraulic-powered press ram and wiper die assembly. Other bends in the part are produced in sequence in accurate relationship.

Bending operations can be performed with or without a mandrel. Wiper die



and mandrel assembly move with the tubing as it is bent, avoiding die marks and wrinkles in the bent parts. Travel of the press ram and wiper die assembly can be controlled in sequence to produce bends of different angles in a single part in an automatic bending cycle.

The press bender illustrated produces two bends with different bend angles in accurate relationship in 2-in. diam welded steel V-8 engine exhaust manifold crossovers at a net production rate of 650 pieces per hour. A 1000-psi hydraulic system powered by a 30-hp motor and a 40-gpm pump operates the ram, mandrel and wiping die cylinders. The die clamping system is powered by a separate 2000-psi hydraulic system powered by a 5-hp motor and a 3-gpm pump.

Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19, Mich. **T-4-1641**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Cutoff Saw

This precision cutoff saw can be set up for any run in 1½ min.

The compact, portable, 1 hp unit will cut up to ¾-in. bar stock in steel for production runs, and larger stock for tooling or short runs. It also will cut up to 1½ in. in nonferrous bar stock for production runs.

Simple in design, the saw can be operated easily and accurately by inexperienced personnel. A fast-acting, heavy-duty integral vise holds the work positively and in exact position. The saw is in alignment on all planes.

The tool is also designed with positive protection against blade disintegration.

Kenco Mfg. Co., 5211 Telegraph Rd., Los Angeles 22, Calif. **T-4-1642**

Impact Wrench

This manually operated impact wrench, called a Swench, delivers torque up to 20 times that applied to the handle, allowing a single operator to manually tighten bolts up to 1¾ in. in diameter to practical tensions. Impact force can be controlled through a simple spring setting, as any desired bolt tension can be produced by the operator through control of the impact force and the number of impacts applied to the fastening.

The Swench has two drive extensions, one for loosening and one for tightening fastenings, and is operated like an ordinary ratchet wrench, using standard

WHEN YOU'RE DEALING WITH PRECISION IN MILLIONTHS . . . DEPEND ON

FONDA

ULTRA *finish*

GAGE

BLOCKS

SQUARE OR RECTANGULAR

IN STEEL OR CARBIDE

WITH ACCESSORIES

Precision in FG *Millionths*

When the order calls for pinpoint accuracy, there can be *no* margin for error! That's why FONDA *Ultra-Finish* gage blocks . . . painstakingly developed and precision engineered . . . guarantee *you* gaging closest to perfection. *Compare!* You'll find FONDA gage blocks and accessories, both price and tolerance-wise, are the *finest* your money can buy! Write *now* for literature and the name of our representative in your area.

D. C. FONDA GAGE CO.

200 HENRY ST., BOX 1050, STAMFORD, CONN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-164

sockets to engage the nut or head of the fastenings. One impact is delivered for every 30 deg of movement of the handle. Impacts may be delivered in succession by continuous movement of the handle in one direction, or, by reciprocating the handle like a ratchet wrench, the operator can apply impacts singly or in short bursts. Each impact produces a clearly audible sound so that the number of impacts may be easily counted.

Control of force delivered by each impact is achieved by settings of an indicator on the head of the spring arbor. Charts are furnished which indicate

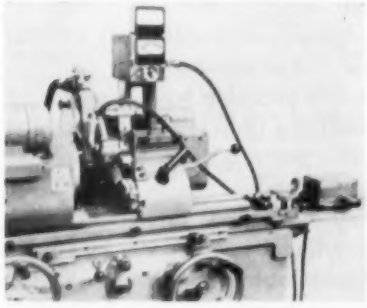
proper spring settings and number of impacts required to produce desired stresses in various bolt sizes.

Three models are available: Model 500 fits ½-in. sockets, takes a range of bolts through ¾ in., is 11 in. long; Model 750 fits standard ¾-in. sockets, takes a range of bolt sizes from ½ through 1¼ in., and is 16 in. long; Model 1000 is designed for 1-in. sockets, and for bolt sizes up to 1¾ in.

Swenson Engineering, P. O. Box 43, Branford, Conn. **T-4-1651**

Grinder Control

The LI-AP Autopairer is designed to automatically control any grinder to produce external pieces to fit bores within limits of desired radial play. Accuracy to 0.000040 in. can be assured



regardless of the type of grinding machine.

There is no need to make mechanical settings on a grinder or resetting for wheel wear, and backlash is electronically compensated.

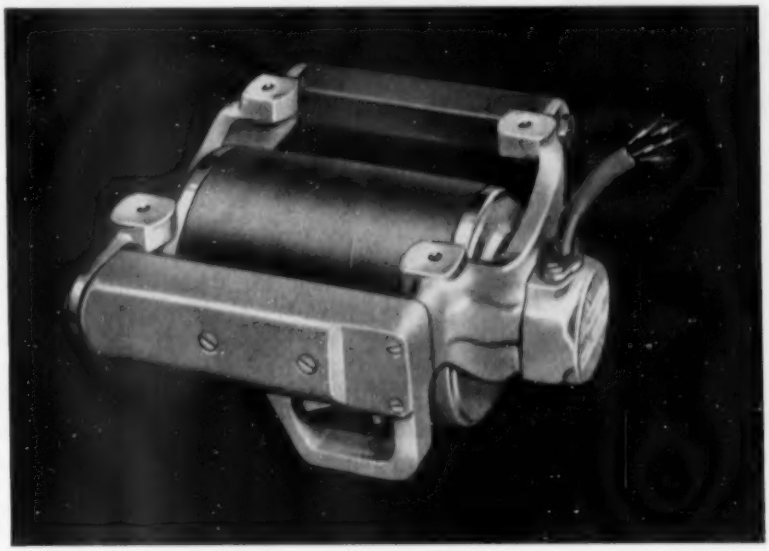
Finished bores are placed on the ID gaging anvil one by one. Large unwieldy pieces can be inserted in the ID gage, which can be located as far as 5 ft from the grinder. The workpiece is then placed in grinding position and automatically ground to fit. No gage readings are necessary.

The ID attachment can be disconnected, converting the unit into an L-1 Autosizer for grinding a series of pieces to an identical size within guaranteed tolerances.

EAM Div., Industrial Gauges, Corp., West Englewood, N. J. **T-4-1652**

Tube and Pipe Notcher

With the Wallace-Pedi notcher metal pipe or tube can be notched on both ends in about 15 sec. to make fit up joints for welding. The operator merely inserts the tube and steps on the pedal. No special skills are required to operate the machine. The machine, made by Franz Diekmann Co. of Germany, will accommodate four dies of maximum capacity, or up to seven dies as size



WALKER makes a complete line of Demagnetizers, including the portable shown here. This demagnetizer is particularly well adapted for removing residual magnetism by rolling the unit slowly along the work. Other types are available, including hollow core demagnetizers.

WALKER Demagnetizers are compensated so that the magnetic flux increases as iron comes into the demagnetizing field. They can be arranged for production line by passing endless belt through aperture to carry work pieces.

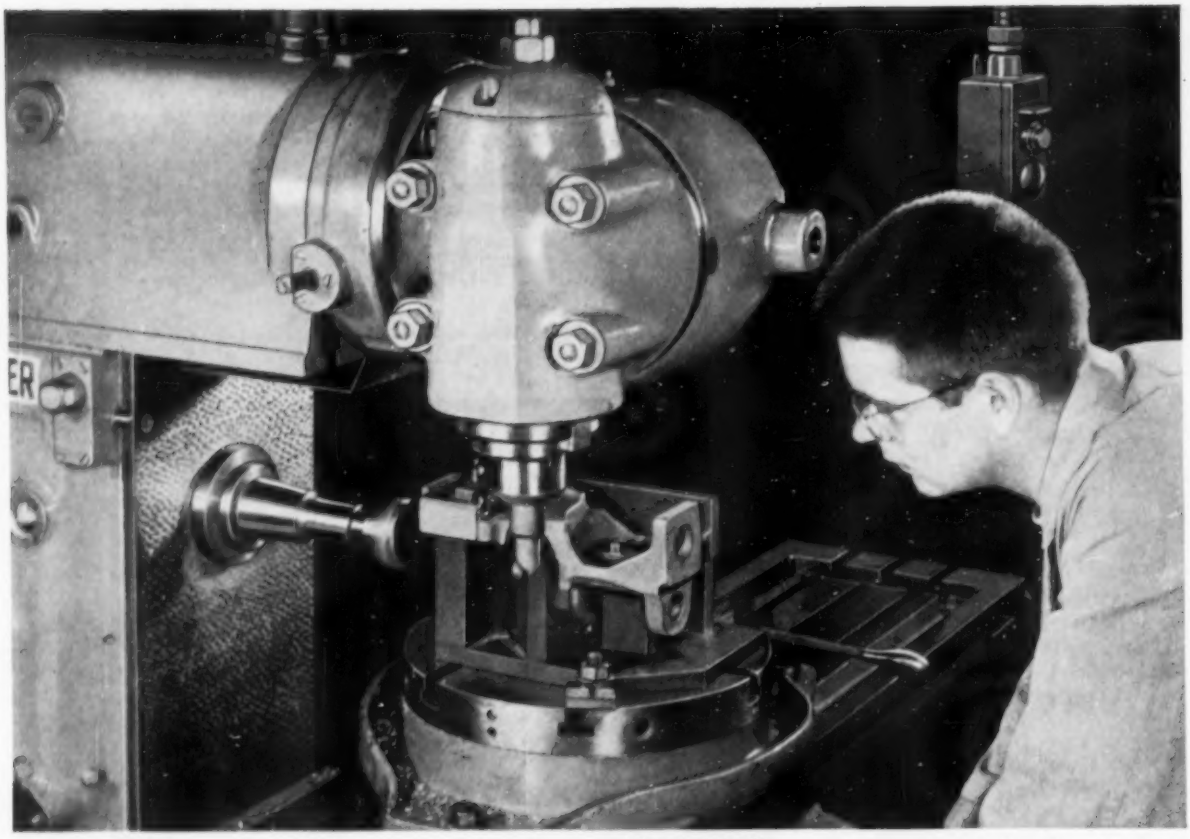
Made by the originators of the magnetic chucks

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

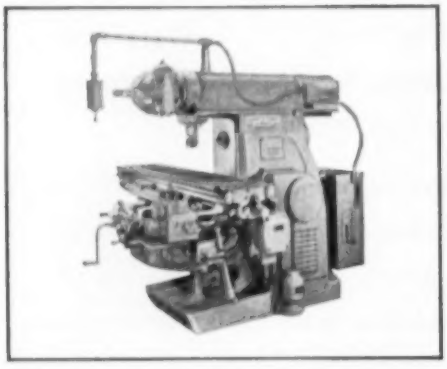
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-165



Horizontal Milling . . . Four-bladed face mill performs four horizontal milling operations on magnesium casting. Simple fixture on rotary table holds workpiece. Four milling positions accomplished through indexing of rotary table.

Vertical Milling . . . using a carbide two-lip end mill in the ram head spindle, three vertical milling operations are completed without disturbing the setup. Rotary table is used for indexing the workpiece.

Multiple setups and excessive handling eliminated



10hp No. 3 Model CH, Plain style Ram Head milling machine with Mono-Lever and Automatic Cycle Table Control and Type U Universal Head.

Kearney & Trecker Ram Head Milling Machine completes seven operations without removing workpiece

Kearney & Trecker's new line of Ram Head milling machines combines a conventional horizontal spindle and a self-contained motorized sliding ram. As a result, horizontal and vertical spindles can be run separately and simultaneously.

The Ram Head machines are available with a choice of three heads — Universal, Vertical and Quill types which can be rotated through 360°. You can perform vertical, horizontal and angular milling on one machine *in a single setup.* They are built in No's. 2, 3, and 4 sizes in both plain and universal styles. Plain machines may be optionally equipped with Mono-Lever and Automatic Cycle Table Control.

For the full story, contact your nearest Kearney & Trecker representative, or write Kearney & Trecker Corp., 6772 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER MILWAUKEE

Designers and Builders of Precision and Production Machine Tools Since 1898

ATLANTA, GA.
Scott Machine Tool Co.
411 Williams St., N.W.

BIRMINGHAM, ALA.
George M. Meriwether Industrial Equipment
1712 Seventh Ave. North

BOSTON, MASS.
Stedfast & Roulston, Inc.
11 Deerfield St.

BUFFALO 23, N.Y.
Syracuse Supply Co.
1965 Sheridan Drive

CHARLESTON, W. VA.
Wm. S. Bolden Co., Inc.
MacCorkle Ave.

CHATTANOOGA, TENN.
Scott Machine Tool Co.

CHICAGO, ILL.
Jackson-Fotsch Co.
7350 West Lawrence Ave.

CINCINNATI, O.
The E. A. Kinsey Co.
327-335 W. Fourth St.

NEW YORK, N. Y.
Kearney & Trecker Corp.
409 Grand Ave.
Englewood, New Jersey

NEW ORLEANS, LA.
Stauss & Haas, Inc.
524 Camp St.

OMAHA, NEB.
Fuchs Mach. & Supply Co.
2401 N. Eleventh St.

PHILADELPHIA, PENN.
Machinery Assoc., Inc.
325 E. Lancaster Ave.
Wynnewood, Penna.

PITTSBURGH, PENN.
Kearney & Trecker Corp.
4 West Manilla Ave.

PORTLAND, ORE.
Harry M. Euler Co.
2811 N.E. Gilsan St.

RICHMOND, VA.
Smith-Courtney Co.
Seventh & Bainbridge Sts.

For details, contact these

KEARNEY & TRECKER DISTRIBUTORS

or write to

KEARNEY & TRECKER CORP.
6772 W. National Ave., Milwaukee 14, Wis.

CLEVELAND, O.
Kearney & Trecker Corp.
Euclid Ave. & E. 17th St.

COLUMBUS, O.
The E. A. Kinsey Co.
1020 W. Fifth St.

DALLAS, TEX.
Greene Machinery Co.
6300 Wyche Blvd.

DAYTON, O.
The E.A. Kinsey Co.
16 Washington St.

DENVER, COLO.
F. J. Leonard Co.
1219 California St.

DETROIT, MICH.
Kearney & Trecker Corp.
10600 Puritan Ave.

GREENSBORO, N. C.
Smith-Courtney Co.
239 S. Davie St.

HICKORY, N. C.
Smith-Courtney Co.
103 3rd Street, S.W.

HOUSTON, TEX.
Steel & Machine Tool Sales
6414 Navigation Blvd.

INDIANAPOLIS, IND.
The E. A. Kinsey Co.
1550 Stadium Drive

KANSAS CITY, MO.
Blackman & Nuetzel Machinery Co.
1103 E. Armour Blvd.

LOS ANGELES, CALIF.
Moore Machinery Co.
3200 S. Garfield Ave.

MILWAUKEE, WIS.
Kearney & Trecker Corp.
6784 W. National Ave.

ROCHESTER 4, N. Y.
Syracuse Supply Co.
311 Alexander Street

ST. LOUIS, MO.
Blackman & Nuetzel Machinery Co.
3713 Washington Ave.

ST. PAUL, MINN.
Sales Serv. Mach. Tool Co.
2363 University Ave.

SALT LAKE CITY, UTAH
Todd Machinery Co.
4165 Holloway Drive

SAN FRANCISCO, CAL.
Moore Machinery Co.
7th & Carleton-Berkeley

SAN JOSE, CALIF.
Moore Machinery Co.
656 Stockton Ave.

SEATTLE, WASH.
Dawson Mach. Co.
5700 First Ave., S.

SHREVEPORT, LA.
Peerless Supply Co., Inc.
701 Spring St.

SYRACUSE 1, N. Y.
Syracuse Supply Co.
314-332 W. Fayette St.

TULSA, OKLA.
White Star Mach. Co.
104 Boulder Bldg.
19 West 10th Street

WICHITA, KAN.
White Star Mach. Co.
301 N. St. Francis

CANADA
MONTREAL
OTTAWA
QUEBEC
TORONTO
WINDSOR
Williams & Wilson Ltd.

KEARNEY & TRECKER MILWAUKEE

of material decreases. There is no need for clamps to hold material. Die widths range from $1\frac{9}{16}$ to $4\frac{3}{4}$ in. Maximum tube size that can be notched in any die is governed by the die width less 0.2 in.

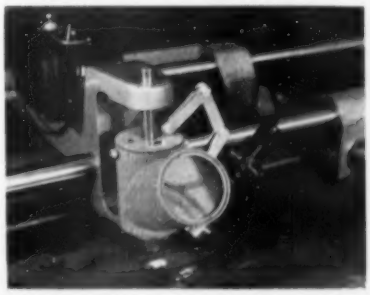
Six models are available, to accommodate maximum OD capacity of from 1 to 4 in. Maximum wall cuts range from 0.080 to 0.220 in.

Distributed by Wallace Supplies Mfg. Co., 1300 Diversey Pkwy. Chicago 14, Ill. **T-4-1671**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Optical Sight

An optical sighting device, called the Dupl-O-Scope, has been added to the Wales Fabricator-Duplicator punching



press for printed circuit fabrication. Mounted in the stylus bracket of the Duplicator, the device permits the operator to optically sight in on a master circuit while the Fabricator punches a corresponding master template. The template is then available for punching all subsequent production printed circuit boards.

The Dupl-O-Scope is a precision casting with fixed focus, 4-power lens and prism. A standard multiring, single cross-hair reticule permits positive centering for punching both round and shaped holes. External light source is adjustable, providing pin-point to 1-in. diameter lighting directly under the objective lens.

Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, N. Y. **T-4-1672**

Hydraulic Contour Grinder

Both internal and external intricate contours are ground automatically on this contour grinder which has standard flat wheels, dressed to very simple radii.

Variable-speed work head also permits polishing and buffing.

To permit the tracer-slide angle-of-travel to change direction, the contour grinder is designed with three angle adjustments in a single-swiveling or pivoting unit. **T-4-1673**

Three-Phase Frequency Converter Control

All timing, sequence and other individual functions of this three-phase frequency converter, resistance welding control are designed and built as individual units, on individual chassis of the sliding drawer type. All inter-connections are made by means of a positive lock plug, mounted so that the control can be operated with the units either locked in place or rolled out. The plug-in units are interchangeable. All accessories are identical except for the motor control which must be in one unit but is not required in the other.

Cold cathode type counting tubes provide a circuit with accurate timing by the power line frequency. Individual sets of counter tubes are provided for each timing function, simplifying main-

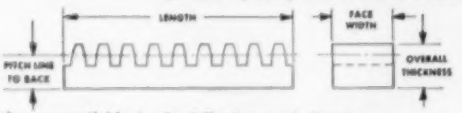
IMMEDIATE SHIPMENT ON
Stock GEAR RACKS

JOB SHOP or QUANTITY
in Stock or Made to Order

Rack Sizes from 48 D.P. to 3 D.P.
in 6 ft. lengths 14½ or 20 pressure angle

WRITE FOR
PRICE LIST
R-1

• When Ordering
please specify Dimensions shown



"Accurate for Service and Dependability When you need it !"

Racks are available in the following stock lengths:

1/8" square	3+ feet
3/16" to 3/8" sq. inclusive	2+ and 4+ feet
1/2" square and heavier	4* and 6* feet

Unless otherwise specified, orders for odd lengths will be furnished from stock in the next longer standard stock length. Special prices will apply for odd lengths furnished to size.

*Approximately 49" and 73" long to allow for cutting or matching.
+Approximately 24-3/8" and 48-3/8" long to allow for cutting or matching.

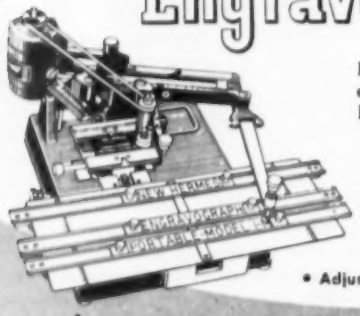
PHONE OR WRITE

Accurate Gear Works
3149 West Grand Ave. ★ Chicago 22, Illinois
Phone: SAcramento 2-5024

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-168-1

Anyone in your plant can engrave
NAMES / NUMBERS
for equipment, parts, panels, bins, etc.

with tracer-guided
Engravograph



Fast, on-the-spot marking with portable engraver, operated by unskilled labor. Engraves plastics or metals directly or on engraving stock.* Big savings on short runs, "one-shot" jobs, hurry-up jobs. 17,000 Engravographs in use.

Patented features:
- Adjustable for 15 ratios
- Automatic depth regulator
- Self-centering holding vise
- Adjustable copy holders

* For top versatility and durability, use GRAVOFLEX chip-proof, flexible plastic, laminated in contrast colors. No filling. Easily sheared, bent, formed, punched. Costs less, lasts longer. Send for sample.

Send for Booklet TE-1

new hermes ENGRAVING MACHINE CORP.
13-19 UNIVERSITY PLACE, NEW YORK 3, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-168-2

tenance, since all timing functions operate either in parallel or in cascade and have similar type circuits. This makes it possible to set up separate heat/cool timing cycles for preheat, weld and postheat, independently of each other. One spare timing unit will serve numerous functions.

The unit, called Digitronic, also has a "Setup/Run" switch which allows the control to be put through normal sequence of operations while the counter tubes remain energized in their counted-out position until the switch is returned to the Run position. This provides an

immediate visual check of timing circuits before an actual run without the use of special test instruments.

Three-phase, d-c heat control system, designed to avoid balance problems, utilizes forced firing system on the ignitrons, operating them from a peaking transformer circuit to prevent variations due to differences in normal firing tolerances. It fires both the positive and negative pulses with the same tube. The d-c phase shift network is self-regulating to maintain a good weld regardless of line voltage fluctuations.

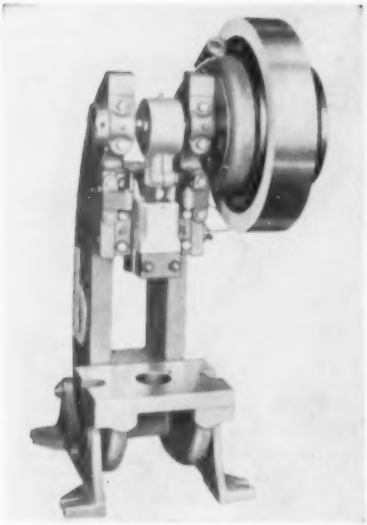
A selective force cycle control provides electronic synchronization and control of both welding force and welding current. Separate heat control panels are provided for each of the various heat functions.

Weltronic Co., 19500 W. Eight Mile Rd., Detroit 19, Mich. **T-4-1681**

Electric Clutch for Presses

Multiple programming of all presses in a production line is possible when the presses are equipped with Benchmaster electric clutches. Individual timing impulses to each press can be supplied by cam, tape, electronically or other means.

There is no time lag between tripping and start of stroke and clutch engagement is immediate. Because no pickup points in flywheel rotation are utilized,



the flywheel can be engaged anywhere in its 360-deg rotation. Engagement is smooth, almost noiseless, and free from shock.

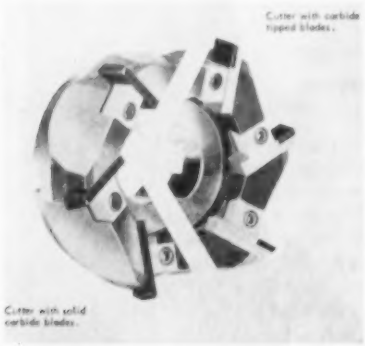
The clutch utilizes no solenoids and has no sliding keys or dogs. It disengages quickly at any position of stroke or cycle. If power fails, clutch is automatically disengaged.

Benchmaster Mfg. Co., 1835 W. Rosecrans Ave., Gardena, Calif. **T-4-1691**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Cutter for Tipped or Solid Carbide Blades

Wedge design of the Eager Beaver face-milling cutter permits use of solid carbide or carbide-tipped blades. Other features of the cutter are fast blade



setting, a negative rake angle, easy sharpening of blades in or out of cutter, quick individual adjustment of blades, and ample chip clearance for freedom from clogging.

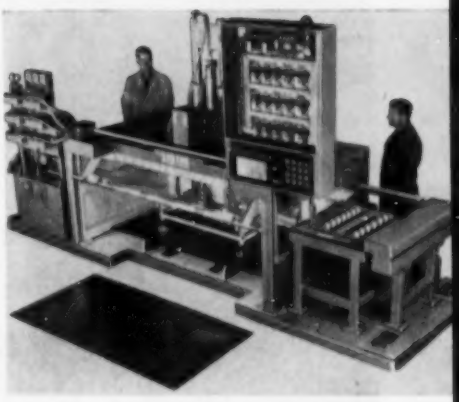
Beaver Tool & Engineering Corp., Box 429, Royal Oak, Mich. **T-4-1692**

Sheet Feeder

This unit automatically feeds blanks successively, from a loaded stack, processes them through the press and progressively ejects the scrap. A special vacuum lift elevates the sheets to the transfer carriage, which in turn feeds them through the press.

The sheet feeder, which can be adapted to take a wide range of sheet sizes and thicknesses, is positioned on rails permitting full access to the press for die removal.

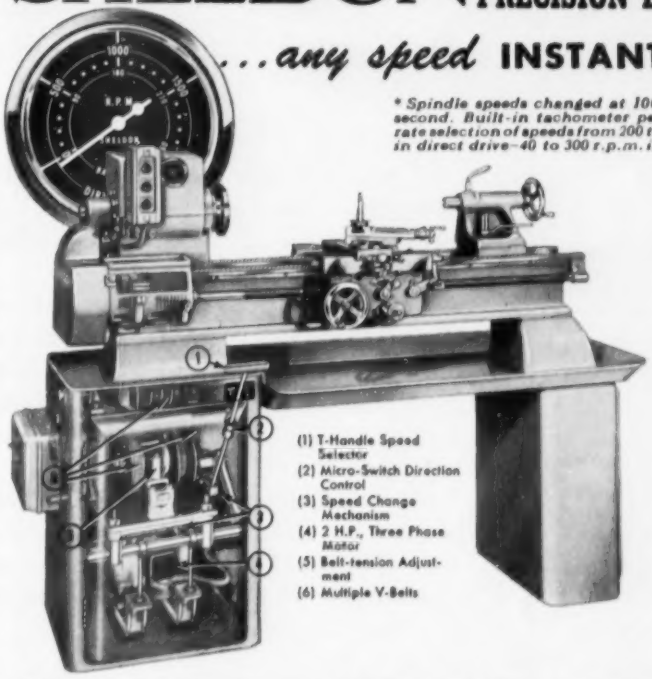
Finished parts drop through the press onto a conveyor. At the proper time the transfer carriage adjacent the press



SHELDON *Variable Speed* PRECISION LATHES

...any speed INSTANTLY *

** Spindle speeds changed at 100 r.p.m. per second. Built-in tachometer permits accurate selection of speeds from 200 to 1800 r.p.m. in direct drive—40 to 300 r.p.m. in back gear.*


(1) T-Handle Speed Selector
(2) Micro-Switch Direction Control
(3) Speed Change Mechanism
(4) 2 H.P., Three Phase Motor
(5) Belt-tension Adjustment
(6) Multiple V-Belts

This new lathe instantly meets every changing speed requirement in the tool room, or quickly sets and holds to any prescribed speed for production runs.

Rugged, Heavy-duty Variable Speed Drive—an oversized unit with double V-belts throughout that delivers positive full-power to the spindle.

High Spindle Speeds—from 200 r.p.m. to 1800 r.p.m. (direct drive), from 40 r.p.m. to 300 r.p.m. in back gear.

Instant and Automatic (power driven) Speed Selection—Only 9 seconds to change from low to high speeds in either direct drive or backgear. Speeds are changed automatically when T-handle is lifted or pushed into engagement.

High Horsepower at All Speeds—Because the drive unit is oversized, it has larger belts which deliver maximum gripping power at all speeds. A 2 H.P., three Phase motor recommended.

Additional lathe features: Zero Precision tapered roller spindle bearings, 54 pitch gear box, heavy cast pedestal, tool-room accuracy. Optional accessories include hardened bed ways, L00 long taper key drive or 4" D1 Camlock spindles.

Sheldon Precision Variable Speed Drive Lathes are available in 11" or 13" Swing. Model WM-56-P (Illustrated) less motor and switch, $1,944.00 F.O.B. Chicago. Other 10", 11", and 13" Sheldon Precision Lathes from $832.00 up. Also 13" and 15" Sebastian Geared Head Lathes, Sheldon Milling Machines and Sheldon Shapers.

Write for Catalog

SHELDON MACHINE CO. INC. 4229 N. KNOX AVE. • CHICAGO 41, ILL.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-169

"Teeth Don't Strip on This "Best for General Cutting"

SIMONDS WAVY SET BAND SAW BLADE

If you cut pipe, angle iron, channel, I-beam, bars, etc. — here's the blade to use because it can handle all types of cutting. It's designed especially for general purpose use.

Note that the teeth are *wavy* set (set in groups) as shown at left. This distributes strain over more teeth and makes it possible to cut all sizes, shapes and types of material *without stripping the teeth.* Fast and smooth cutting, it stands more abuse, lasts longer, cuts costs.

This general purpose blade is made of tough, wear-resistant alloy steel and is available in a variety of widths and tooth spacings. It will pay you to try SIMONDS Wavy Set Blade for *your* general purpose cut-off work.

QUICK FACTS

- Cuts all shapes and types of materials
- Saves changing saws — one saw can do the work of several
- Longer life — cuts blade costs
- Withstands abuse
- Furnished in 100 and 250' Coils or Welded-to-Length for Specific Machines

WAVY SET BAND SAW BLADE SIZES

Width Inches	Thickness	Teeth per Inch
½	.025	10-14-24
⅝	.032	10-14
¾	.032	8-10-14-18
1	.035	10

125 years of growth 1832-1957

For Fast Service from Complete Stocks Call your SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS SAW AND STEEL CO. FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon, Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

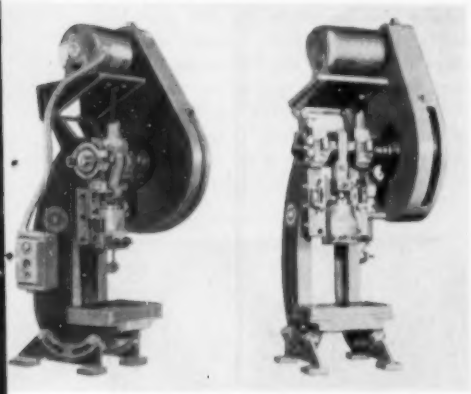
clamps the scrap and ejects it onto a conveyor. The sheet feeder is hydraulically powered by two pumps which in turn are driven in tandem by a 10-hp electric motor operating at 1800 rpm. Maximum sheet capacity is ¼ by 40 by 78 in. in a 24-in. stack height.

Hautau Engineering Co., 721 Wanda Ave., Ferndale 20, Mich. **T-4-1711**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Bench Presses

Developed particularly for the electronic, electrical and light metalworking industries by Bliss, San Jose, Calif. Div., this line of bench presses includes a 4-ton adjustable bed and horning press, 4 and 7-ton inclinable presses,



illustrated and a 10-ton fixed bed press.

Features of the line are extra long slides, renewable ball seats and bronze ball cap bushings, cast Meehanite frames, split-bronze bearings and extra-long removable V-type gibbing.

The presses can be equipped with the rolling key clutch or an air friction clutch.

E. W. Bliss Co., Canton, Ohio.
T-4-1712

Centerless Belt Grinder

Designed for high-speed volume production on ferrous, nonferrous, plastic, glass and other materials, this wet-or-dry belt centerless grinder offers continuous through-feed permitting use of gravity feed hopper for small cylindrical parts, which are automatically ejected at opposite end. It accommodates stock from 3/32 to 2¾-in. in diameter in any length, and maintains tolerances of 0.001-in. at through-feed rates up to 35 fpm.

Typical grinding sequence of this Model L4-3, using series of progressively finer-grit abrasive belts, is rough grind, finish grind and fine polish. The machine is also available with four

W&B
DISTRIBUTORS
OF DRILLS, REAMERS AND CARBIDE TOOLS
SERVE YOU BEST!
With
A wider range of sizes and styles
Rapid off-the-shelf deliveries at lower cost
Uniform high quality for longer tool life
Sound advice in selecting the right tool
Take the first step toward increased production and lower tool costs! Contact your Whitman & Barnes distributor for complete information or write direct for free Catalog 106!
W&B
"Makers of Fine Tools Since 1848"
WHITMAN & BARNES
DRILLS and REAMERS
40120 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN
NEW YORK • CHICAGO • LOS ANGELES
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-171

FOR *Fast, Low Cost* DRILLING
OF HARDENED STEEL, USE

ACE

"HI-BRINELL" DRILLS

When it comes to drilling hardened ferrous materials in the range of 45 to 65 Rockwell "C" and harder, you can't beat Ace "Hi-Brinell" Drills. They're designed especially to handle tough jobs that ordinary drills won't touch. Ideal for salvaging and repairing hardened steel parts . . . a "must" for every tool room, die shop, machine repair department. They're built to give you extra long service life, too. The tungsten carbide tips have ample negative rake to eliminate thin projecting angles and permit faster, easier cutting. And they're stocked in a wide range of sizes and lengths to meet your particular requirements. Call your Ace Distributor or send for complete information today!

ACE DRILL CORPORATION
Adrian, Michigan

Gentlemen: Please send me your Catalog No. 52-A containing complete information on ACE "Ground-from-the-Solid" Drills and hardened H.S.S. drill blanks.

NAME_____

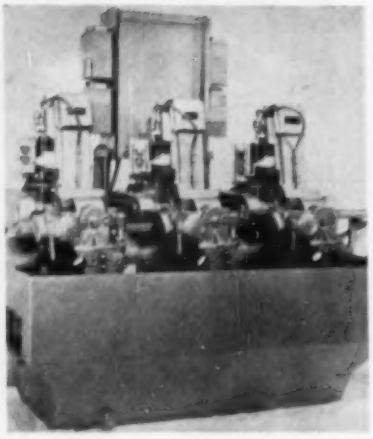
COMPANY_____

ADDRESS_____

CITY_____ STATE_____

ACE DRILL
ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS
INDICATE A-4-172



grinding heads where an additional operation is required. Each head is equipped with individual control panels and micro-stop size control.

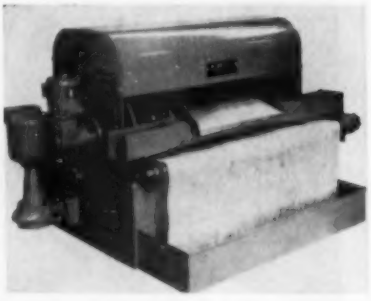
Through-feed rates are controlled by adjustable helix angle of regulating wheel, in combination with change gears which drive regulating wheels at different rpm. Belt speed is 5000 sfpm, and abrasive belts, 4 x 54 in., can be changed in less than a minute.

A self-contained coolant system applies coolant directly to grinding area and also jet-sprays abrasive belt to prevent belt loading and insure maximum cutting effect.

Engelberg Huller Co., 831 West Fayette St., Syracuse 4, N. Y. **T-4-1721**

Coolant Filter

Efficient filtering of coolants to remove foreign particles is provided by the redesigned BarnesdriL Kleenall filter. Change of the intake distributor



from pipe to trough type permits cleanout of sludge dropout and foreign material during operation of the filter and avoids down time.

In the redesigned unit, the drive has been placed on the front idler shaft, and increased size of seal wheels provides greater area for sludge build-up. Torque motor size has been increased on larger models.

Five sizes are available, ranging in over-all width parallel to axis of from 25½ to 66½ in. Each size varies in capacity, depending on the type of filter fabric used. All models have an over-all length of 32 in. and over-all height above the tank of 23⅛ in.

Barnes Drill Co., 815 Chestnut St., Rockford, Ill. **T-4-1722**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Portable Hardness Tester

Direct readings from Rockwell A, B or C scales or Brinell medium or low scales can be made on this portable metal hardness tester. Accurate readings are obtained quickly on practically any size, shape or type of metal merely by placing the tester on the metal, pressing the handgrips down and reading the dial. There is no need for conversion charts or calculations. Each

instrument is individually calibrated to 1.5 pts. Rockwell and 5 pts. Brinell.

The tester is used on a wide range of metal parts or products, thick or thin sections, flats or rounds. There is no limit in size or shape. All instruments are furnished complete with diamond penetrator and one test block. For continuous-run testing, a Newage bench adaptor is also available.

Newage International, Inc., 222 York Rd., Jenkintown, Pa. **T-4-1723**

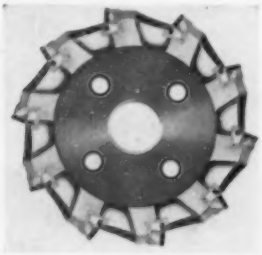
Carbide Face Mills

High-feed milling of flat surfaces is the manufacture of this series of Free Clear inserted-blade carbide-tipped face milling cutters designed to produce good finish and clean edges with good chip disposal.

Standardized for machining light metal alloys, a higher feed-per-tooth is possible because the corner angle does all the cutting. Chip thickness is always

less than this feed per tooth. The blades take a ¼-in. depth of cut. Feed rate is 45 ipm. Optimum speed is 1600 sfpm. No coolant is required.

Because the inner end of the corner angle enters the cut ahead of the outer end, impact between cutter and work is reduced. Chips are curled upward and outward away from the machined sur-



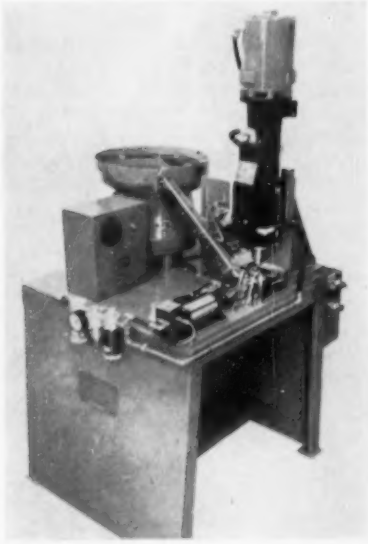
face and away from the cutter itself. This cutting action prevents scoring the surface milled, and chips do not clog in the cutter.

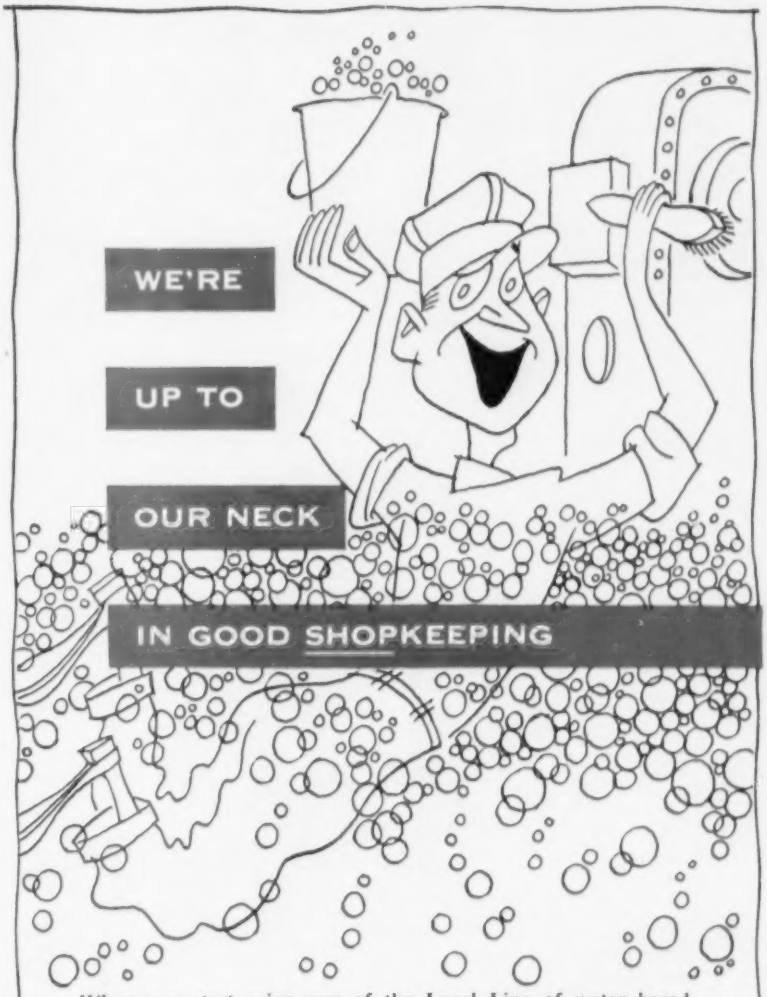
Cutters are standard in RH or LH cut in 8 sizes: 8¼ to 18-in. OD and widths of 2¼ or 2½ in. Made-to-order sizes range as small as 4-in. OD in shell or shank integral type. Blades and wedges are stocked.

Goddard & Goddard Co., 12280 Eurt Rd., Detroit 23, Mich. **T-4-1831**

Automatic Tapping Unit

More than 1500 pieces are produced per hour by this automatic tapping machine for small parts. The unit, as illustrated, consists of a vertical tapping unit, vibratory feeder, gravity track, an escapement, a work feeder which positions and clamps the part securely in the tapping fixture and an ejector





When you start using any of the Lusol Line of water based metalworking products, you get much more for your money than a drum of coolant concentrate. In fact, you begin a practical and proven shopkeeping program that starts with clean machines and keeps them clean. Once followed, the results are spectacular from the operator's point-of-view alone. Smoke, odor, oily floors are no longer health and safety hazards. Dermatitis is eliminated. Work clothes stay cleaner.

While these improvements obviously help morale and hence production, the working advantages of Lusol are even more spectacular. The clear solution allows the operator to see the work. Lusol, with the highest heat removing capacity of all coolants regardless of type, keeps tools cooler so cutting edges last longer. Work pieces remain cooler so closer tolerances can be maintained. All around, Lusol is better for the work and better to work with. It will pay you well to investigate.

PROTECT EMPLOYEES AND YOU PROTECT YOUR COMPANY

THE Lusol LINE
BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.
BOX 213, PORTLAND, CONNECTICUT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-173

mechanism which discharges the part into a chute.

The basic design may be modified, on special order, so that the machine may be adapted to automatic drilling or assembling.

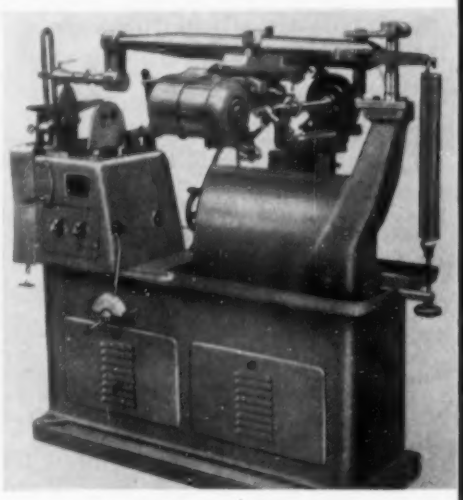
Automatic Development Corp., 135 Reynolds Rd., Mentor, Ohio. **T-4-1741**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Multipurpose Machine

Multitoothed and staggered tooth milling cutters for climb and conventional milling can be relief-milled and form-ground on the Jemco automatic cutter, milling and grinding machine.

A template copying attachment is available for the machine, making it possible to cut machine components such as cam segments, rachet sections, tripping mechanisms, etc. An indexing mechanism, which allows the machine to be used as a copy milling machine, permits rotation of the work so the form being cut on the work can be repeated symmetrically or on any angular position controlled by the indexing mechanism. A simple alteration allows the same



template to produce cutter teeth of the same form in a broad range of sizes.

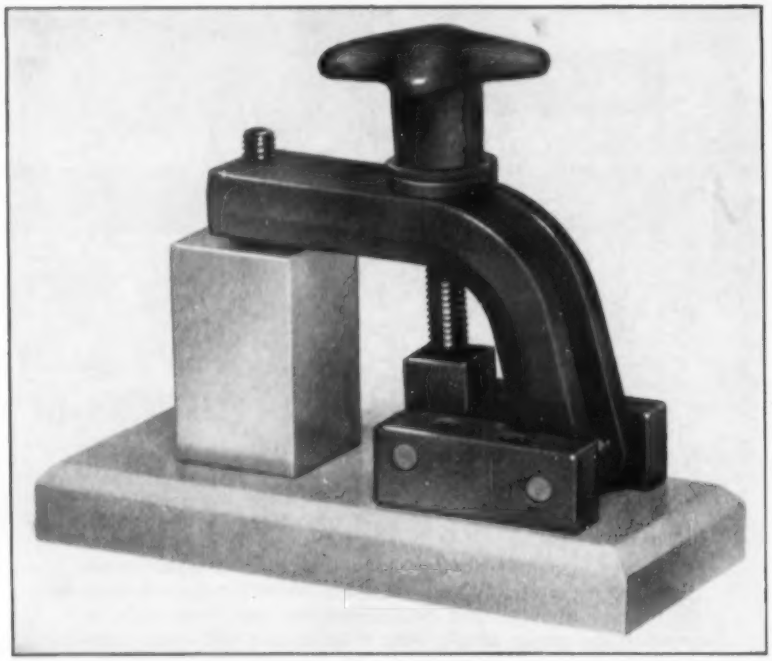
Attachments are available for cutting spirals with infinite variation up to 36 deg, staggered-tooth plane and form cutters, as well as trapezoidal thread cutters with staggered teeth, can be cut automatically. Automatic relief grinding of milled and hardened form cutters is also possible.

Jersey Mfg. Co., 455 Livingston St., Elizabeth, N. J. **T-4-1742**

Indicator Gage

Adjustable indicator gages developed for quick accurate measurement of shallow slots, grooves and holes can be used at a machine to check depths ranging from 1/32 to 1/2 in., ordinarily without moving the table or disturbing the setup. The gage, called Shalo-Chek, is available in three standard models for checking dimensions ranging from 1/2 to 6 in., 4 to 12 in., and 10 to 18 in.

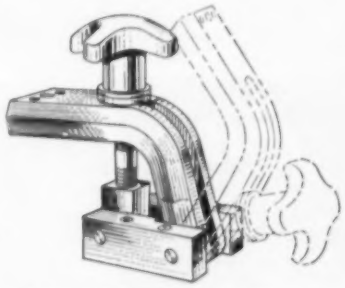
The gage, which is 1 13/16 in. high, can be used with No. 1 AGD standard dial indicators, or with any air gage instru-



Infinite Variety

LODDING RETRACTING CLAMPS

Lodding Retracting Clamps lend themselves to infinite variation. Jaws are added to suit work. Tapped and clear holes are there for you to use. Lodding provides four types of action—and your own imagination is the limit to the variety of jaws you can add. Four sizes each of four styles—hand knob, hand cam, nut and air operated.



LODDING, INC.
Worcester 1, Massachusetts

FACTORY WAREHOUSES

Precision Tool Sales	Bagby Engineering Co.
417 E. Florence Ave.	1047 Forest Ave.
Los Angeles 3, Calif.	Evanston, Ill.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-174

ment by means of an adapter block and a contact air cartridge. Each model is furnished complete in its own case, which includes a pair of carbide contact gaging fingers, two wrenches, an adapter block for OD checking, and five sets of rest buttons to gage at depth of 1/32, 3/32, 5/32, 7/32 and 9/32 in.

Because there is no "feel" involved in the use of these gages, errors in readings due to human element are avoided.

Ellstrom, Inc., Dearborn, Mich. **T-4-1751**

Drill Grinding Machine

This drill grinding machine offers four-plane grinding to assure proper centering of the drill point, and equal lip angles and length. Grinding angles can be adjusted in the same manner as for other cutting tools. Simple adjustments and minimum movements provide quick and easy operation. A differential wheel-dressing device assures precise duplication. No special skill is required by an operator to use the equipment.

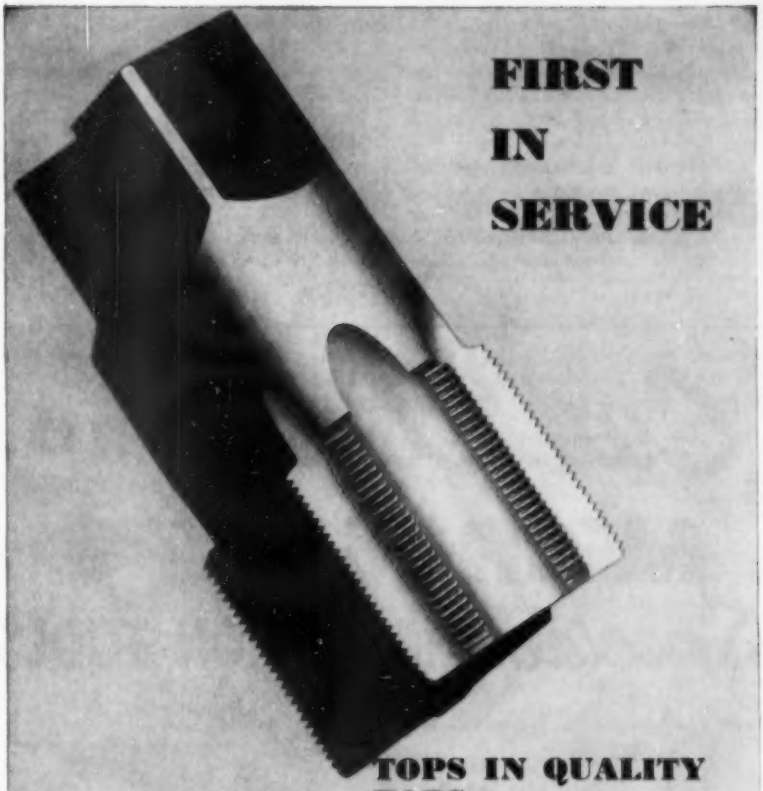
The machine will grind right and left-hand drills either straight or helical; provide point grinding angle from 90 to 140 deg; and variable rake angle from 0 to 20 deg. Long drills may be ground without special equipment.

Intermachinery Corp., 452 Fifth Ave., New York 18, N. Y. **T-4-1752**

Surface Agents

Four non-ionic surface-active agents, marketed under the name of Poly-Tergent, are available for general industrial use as emulsifiers, wetting agents, detergents and dispersants in the textile, paper, leather, metalworking and other industries. They are characterized by chemical stability and complete compatibility with acids, alkalies and other detergents, particularly the cationic type. All four are alkyl phenol polyglycol ethers. They are liquids made from petroleum-base materials.

Poly-Tergent B-200 is useful in sol-



FIRST IN SERVICE

TOPS IN QUALITY TAPS . . .

Hanson-Whitney has the long experienced know-how that leads the field in standard and special taps. H-W was first in introducing the "finished after hardening" process, developing the ground-thread tap for industry. Today, H-W has a proven background in the production of taps that assures absolute tops in quality, performance and dollar value.

Example: H-W skilled processing attains a finer concentricity between shank and thread which assures a far greater extent of continued uniformity in tapped holes. And it's performance like this, that enables your production specialists to cut costs over long-range programs.

For further cost economy . . . your schedules can depend on local H-W distributor service . . . providing complete stocks of all standard taps . . . plus H-W field engineering assistance on all special requirements.

Write for complete literature.

Hanson-Whitney COMPANY

Division of THE WHITNEY CHAIN CO.

171 Bartholomew Ave., Hartford 2, Connecticut

TAPS : THREAD GAGES : HOBS : CENTERING MACHINES : THREAD MILLING MACHINES AND CUTTERS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-175

vent systems as a detergent and dispersant and where reduction of interfacial tensions will aid in wetting and spreading. As an emulsifier, it may be used alone or in combination with the more hydrophilic types.

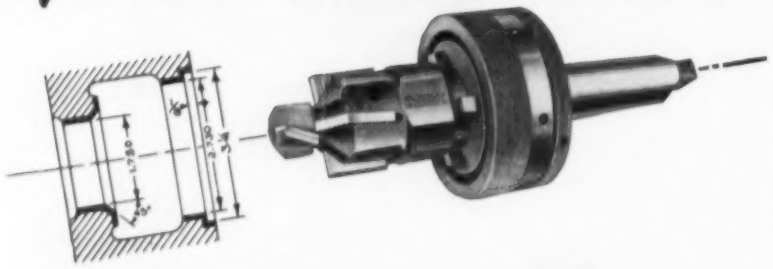
Poly-Tergent B-300 foams well and possesses good properties as a wetting agent, detergent, emulsifier and dispersant. It is completely soluble in water up to temperatures of 52-56 C and in some organic solvents.

Poly-Tergent G-200 is intended primarily as an emulsifing agent and associate emulsifier. It is useful in many solvent systems to increase detergency, dispersibility and wetting action, serves as an active soap in dry cleaning solvents, and is compatible with cationic compounds.

Poly-Tergent G-300 is completely soluble in water up to 62-70 C and in a number of organics. Highly stable chemically, it is a good wetting agent, detergent and dispersant over a wide range of conditions. It gives good emulsions with aromatic solvents, chlorinated paraffins, and vegetable oils. It wets and suspends such materials as clay, pigments, carbon black and red iron oxide.

Industrial Chemicals Div., Olin Mathieson Chemical Corp., Baltimore, Md. **T-4-1761**

Cut Costs WITH McCROSKY COST CUTTING TOOLS Special PRODUCTION TOOLS



do 3, 4, 5 or more operations at the same time ***1 tool—1 setup***

• Engineered specially to your work prints, McCrosky "Specials" combine related facing, boring, counter-boring and chamfering operations — perform them all simultaneously. This assures absolute concentricity and uniformity of finished pieces — eliminates stock-piling and re-handling between operations — speeds up production — reduces the amount of work in process — shortens deliveries — and produces other economies so great that they pay their way even on moderately short runs. Send your work prints to McCrosky, and write for a "Specials" bulletin. It gives complete details; illustrates nearly 50 typical examples.

The complete McCrosky line includes:

Jack-Lock® Milling Cutters — *Wizard*® Quick-Change Chucks
Super® Adjustable Reamers — *Block Type* Boring Bars
Turret Tool Posts — *Specially Engineered* Multiple Operation Tools

Fully descriptive catalogs sent promptly on request. Write for yours today!

McCROSKY TOOL CORPORATION
MEADVILLE, PA.

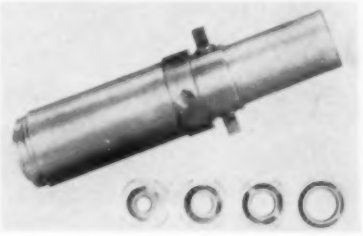
Engineering and Sales Representatives in the Principal Cities
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-176

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Nipple Chuck

Use of Speed-Thru nipple chuck facilitates on-the-job fabrication of pipe and conduit nipples of any length by means of hand threading or by use of any power drive. The sleeve guide can be moved, so there are no dead spots to prevent threading to any predetermined length.

Each nipple chuck comes with holding adapters from ½ to 1½ in. diameters. Two-inch diameter nipples thread into the chuck body for holding. Adapter bushings of ⅛, ¼ and ⅜ in. are optional. Over-all length of the chuck is less than 10 inches. The chuck will also be available with adapters for British Standard pipe thread.



Mercury Hydraulics, Inc., 2440 Blake St., Denver 5, Colo. **T-4-1762**

Convex-Radius Grinder

This convex-radius grinder can grind either the right or left side of a milling cutter or a single-point tool to a 90-deg radius. It can also grind a 180-deg convex radius in a single setup.

There is no need for form dressing of the wheel. Including rough and finish grinding, total setup and machining time for the average milling cutter is less than one hour.

Beyond ability to read a micrometer dial and a vernier height gage, no special skill is required to set up and operate the unit.

Due to its precision construction, the machine will produce the exact radius

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-4-172	Ace Drill Corp.	**Carbide Drills**—Catalog contains data on Ace "Ground from the Solid" Drills and H.S.S. drill blanks. (Page 172)
A-4-236	Almco Div. of Queen Stove Works, Inc.	**Finishing**—Booklet contains facts and processes on barrel finishing, including detailed cost chart on finishing of typical parts. (Page 236)
A-4-235	American Broach & Machine Div. Sundstrand Machine Tool Co.	**Broaches**—Information on practical broaching methods contained in Bulletin A713. (Page 234-235)
A-4-212	Armstrong Bros. Tool Co.	**Cutting Tools**—Catalog No. 57 contains data on Armstrong tools for industry. (Page 212)
A-4-52	The Blanchard Machine Co.	**Special Machines**—"The Art of Blanchard Surface Grinding" and 5th edition of "Work Done on the Blanchard" now available. (Page 52)
A-4-314	E. W. Bliss Co.	**Presses**—Catalog No. 27-C describes the entire line and gives range of work accomplished with Bliss presses. (Page 314)
A-4-287	Boston Gear Works	**Speed Reducers**—Catalog 56 lists specifications and engineering data. (Page 287)
A-4-42	The Carborundum Co.	**Abrasives**—Maximum Automation Potential with abrasive belts described in M-A-P brochure. (Page 42)
A-4-275	The Challenge Machinery	**Measurement**—Precision surface equipment described in Catalog No. 838W. (Page 275)
A-4-217	Chicago Rivet & Machine Co.	**Rivets**—Catalog contains engineering data and rivet specifications. (Page 217)
A-4-211	Circular Tool Co., Inc.	**Cutting Tools**—Catalog O contains data on Circle R slitters. (Page 211)
A-4-238-3	Composite Forgings, Inc.	**Die Sections**—Composite die sections described in booklet "Engineering Data." (Page 238)
A-4-312-3	Comtor Co.	**Dial Gages**—Bulletin 50 describes Comtorplug precision internal gage. (Page 318)
A-4-10	Crucible Steel Co. of America	**High-Speed Steel**—"Crucible Publication Catalog" contains helpful hints on Rex and other special steels. (Page 10)
A-4-268-4	J. Arthur Deakin & Son	**Special Machines**—Catalog D describes Alexander die sinkers and other British machines. (Page 268)
A-4-27	DeVlieg Microbore Co.	**Special Tooling**—Catalog 56 describes Microbore tooling and methods. (Page 27)
A-4-202-1	The Eastern Machine Screw Corp.	**Die Head**—"Unified and American Screw Thread Digest" sent upon request. (Page 202)
A-4-45	Eastman Kodak Co.	**Projectors**—"Projection Gaging with Kodak Contour Projectors" describes Kodak simplification of measurement and inspection problems. (Page 45)
A-4-204	Eclipse Counterbore Co.	**Cutting Tools**—Engineering specifications contained in Counterbore Catalog No. 51 and End Mill Catalog No. 56. (Page 204)
A-4-161-1	The Gaertner Scientific Corp.	**Optical Measurement**—Bulletin 188-53 describes new Gaertner coordinate Cathetometers. (Page 161)
A-4-60	Galland-Henning Nopak Div.	**Cylinders**—Catalog 105 describes Nopak-matic plus valves. (Page 60)
A-4-23	Gisholt Machine Co.	**Turret Lathes**—Bulletin No. 1174-B covers features, accessories, tools and floor plans on Gisholt Masterline ram type turret lathes. (Page 23)
A-4-216	Goddard & Goddard Co.	**Cutting Tools**—Catalog "F" lists standards available and describes Go & Go designing service. (Page 216)
A-4-57	Greenlee Bros. & Co.	**Automatics**—Catalog A-405 contains information on Greenlee automatic bar machines. (Page 57)
A-4-34	Hannifin Corp.	**Cylinders**—Hannifin cylinder file contains data on lines of Hannifin cylinders (Page 34)
A-4-55	The Hartford Special Machinery Co.	**Special Machines**—Bulletin TR-102 describes how screws or nails are threaded with Hartford special automatic thread rollers. (Page 55)
A-4-1	The Heald Machine Co.	**Special Machines**—Vertical Bore-Matics and other types of precision finishing machines described in Bulletin 2-352-1, Issue 1. (Inside Front Cover)

USE THIS HANDY FORM ➡

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

457 *THE TOOL ENGINEER DETROIT 38, MICH.*

READER SERVICE CARD

Please send me further information as indicated below:

(Mark Key Number of trade literature, tools or advertisements)

ADVERTISERS	TRADE LITERATURE	TOOLS OF TODAY
A—	L—	T—
A—	L—	T—
A—	L—	T—
A—	L—	T—

NAME _____ POSITION _____

FIRM _____ BUSINESS _____

Please Check One ☐ Firm Address ☐ Home Address } STREET _____

CITY _____ ZONE NO. _____ STATE _____

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-4-315	Ideal Industries, Inc.	**Centers**—Catalog contains specifications on Gold Band live centers. (Page 315)
A-4-180	The Lapointe Machine Tool Co.	**Broaches**—"How To Care for Broaching Tools" describes care of broaches. (Page 180)
A-4-289	The Lincoln Electric Co.	**Welding**—Bulletin SB-1355 describes automatic Lincolnweld. (Page 289)
A-4-195	F. J. Littell Machine Co.	**Machine Attachments**—Catalog describes and lists specifications of Littell air vacuum units. (Page 195)
A-4-44	Madison-Faessler Tool Co.	**Cutting Tools**—Bulletin describes Madison-Faessler Roller-Burnishing Tool. (Page 44)
A-4-9	Mall Tool Co. Div. of Remington Arms Co., Inc.	**Air Tools**—Catalog describes Mall line of air tools. (Page 9)
A-4-296-3	Metal Carbides Corp.	**Carbide Metals**—Catalog 56-G contains data on talide metal. (Page 296)
A-4-271	Metallurgical Products Dept. of General Electric Co.	**Cutting Tool**—Catalog GT-316 contains new Grade Selection Guide for Carboloy cemented carbides. (Page 271)
A-4-252-3	W. F. Meyers Co., Inc.	**Cutters**—Catalog 52 contains data on "Meyco" carbide saws and cutters. (Page 252)
A-4-290-3	The Middlestadt Machine Co.	**Tools and Dies**—Brochure describes Middlestadt engineering services and special machinery. (Page 290)
A-4-207	Nelco Tool Co., Inc.	**Cutting Tools**—Catalog describes over 700 carbide cutting tools. (Page 207)
A-4-168-2	New Hermes Engraving Machine Corp.	**Special Machines**—Booklet TE-1 describes tracer-guided Engravograph. (Page 168)
A-4-190	Oakite Products, Inc.	**Special Machines**—"Precision Barrel Finishing" contains information on deburring, descaling and burnishing. (Page 190)
A-4-68	The Ohio Crankshaft Co.	**Induction Heating**—Catalog G shows Tocco induction heating equipment from 60 to 600,000 cycles. (Page 68)
A-4-264	The Osborn Mfg. Co.	**Brushes**—Centerless brushing method described in Catalog 210-C. (Page 264)
A-4-13	R and L Tools	**Special Tools**—R and L tap and die holder and other R and L turning tools described in catalog. (Page 13)
A-4-201	Reed Rolled Thread Die Co.	**Thread Rolling**—Attachment Bulletin B-1 describes Reed thread-rolling attachments. (Page 201)
A-4-48	Rivett, Inc.	**Valves**—Catalog No. 216 gives circuit design showing specifications, cutaway views, hydraulic valves. (Page 48)
A-4-214	Rockford Clutch Div. Borg-Warner	**Clutches**—Bulletin shows typical installations of Rockford clutches and power take-offs. (Page 214)
A-4-218	The Rotor Tool Co.	**Air Tools**—Bulletin 46 gives specifications on Rotor S-02 air screwdrivers. (Page 218)
A-4-312-2	Royco Tap & Tool Corp.	**Taps**—Catalog contains data on Royco precision ground taps. (Page 312)
A-4-241	Simonds Abrasive Co.	**Grinding Wheel**—Catalog Bulletin ESA-272 describes Simonds grinding wheels for toolroom use. (Page 241)
A-4-215-1	Standard Parts Co.	**Machine Components**—Illustrated catalog describes jig and fixture components. (Page 215)
A-4-254	Unbrako Socket Screw Div. Standard Pressed Steel Co.	**Cap Screws**—Form 2193 gives complete catalog and technical data on the entire line of Unbrako socket screws with Nylok self-locking device. (Page 254)
A-4-259	The L. S. Starrett Co.	**Measurement**—Catalog No. 27 describes and illustrates the complete Starrett line of measuring instruments. (Page 259)
A-4-233	Sundstrand Machine Tool Co.	**Special Machines**—"Engineered Milling Production" available in Bulletin No. 778. (Page 232-233)
A-4-286	S. B. Whistler & Sons, Inc.	**Dies**—Catalog describes Whistler adjustable perforating dies. (Page 286)
A-4-306	Willey's Carbide Tool Co.	**Carbide Products**—Illustrated catalog describes work support blades for centerless grinders and other Willey carbide products. (Page 306)
A-4-179-1	The Yoder Co.	**Special Machines**—Catalog describes cold-rolled forming applications to a multiplicity of mass production needs. (Page 179)

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

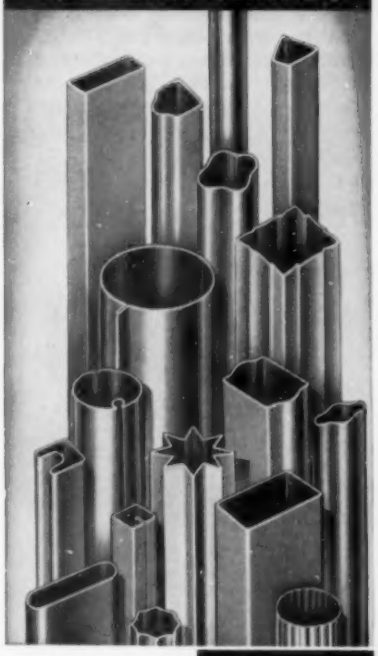
FIRST CLASS
PERMIT NO. 10782
(Sec. 34.9, P.L. & R.)
DETROIT, MICH.

THE TOOL ENGINEER
ASTE Building
10700 Puritan Ave.
Detroit 38, Mich.

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

COLD ROLL FORMING TUBULAR SHAPES



Among the wide variety of things you can make on a Yoder Cold Roll Forming machine are round, square, oval, rectangular and other tubular shapes, such as illustrated. The seams may be open, lapped, butted, dove tailed, interlocking, etc.—as shown in the drawing.

Millions of feet of such unwelded tubular shapes are made from coiled strip for conductor pipe, bedsteads, lamp stands, window channel, wiring raceways, carrying rods, etc. Production ranges from 20,000 to 50,000 feet per day, with only one operator and a helper.

Yoder offers you the cooperation of their engineering staff for designing and adapting their cold roll forming machines, auxiliaries, and tooling, for the low cost production of structurals, mouldings and trim, panels, tubular and other shapes, to meet individual needs.

The Yoder Book on Cold Roll Forming is a complete, illustrated text on the art and the equipment needed for performing a variety of operations which can be combined with cold roll forming, at little or no extra labor cost. A copy is yours for the asking.

THE YODER COMPANY
5525 Walworth Ave. Cleveland 2, Ohio

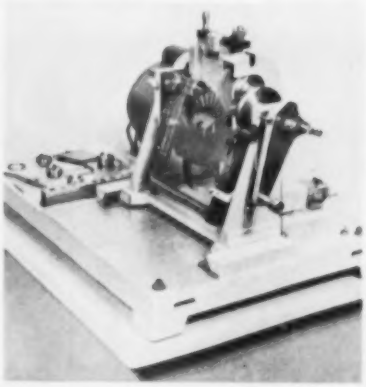
YODER COLD-ROLL FORMING MACHINES

INDICATE A-4-179-1

for which the micrometer dials have been set.

Radii are infinitely adjustable from zero to maximum diameter. Two different radii on the two sides of the cutter can be ground. Milling cutters with either 1 or 1¼-in. bore, ranging in size from 3 to 6 in. in diameter, and from up to 2 in. in thickness can be ground on the standard machine. Special adapters for grinding tool bits in sizes of ¼, 5/16, ⅜ and ½ in. are furnished as standard equipment.

The machine is designed so that the minimum side clearance of one degree



is produced automatically. A 4-in. diameter grinding wheel with ½-in. diameter bore is used. Face width of the standard wheel is ½ in., although wheels up to ¾ in. wide can be used.

Grinding wheel speed is 5200 rpm. The wheel is V-belt driven from a ⅛-hp, single-phase, 60-cycle, 115/230 volt electric motor.

Nassau Tool Works, 208 Meacham Ave., Elmont, L. I., N. Y. **T-4-1791**

Hydraulic Presses

Model 300A series King hydraulic presses are designed for capacity conversion by means of easily installed kits. A 65-ton capacity press, for example, may later be converted to 300-ton. Kits cover 65, 125, 170, and 300-ton conversions. The presses are supplied with self-contained hydraulic systems and controls, or as basic units to be connected to a central system.

Welded steel press construction is internally ribbed to provide maximum strength and torsional load resistance. Deep box type upper platen provides an extra long bearing surface. Eight adjustable bronze gibs on the plates permit adjustment for precise alignment in any direction. The package unit hydraulic system is mounted in a tray on top of the press which serves to capture any oil leakages for convenient drain-off. To operate the press, a simple lever control is standard, but automatic

Special Size Reamers ARE STANDARD WITH L&I

TWO MORE L&I EXCLUSIVES ...AT NO EXTRA COST!

DOWEL PIN REAMERS

Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.

14 Sizes from .1230 thru .4995" Sets, tool

OVER & UNDER SIZE CHUCKING REAMERS

Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.

14 Sizes from .124 thru .501" Sets, tool

These reamers are two more reasons why L&I is the source for a complete reamer line.

See your L&I Distributor.

L&I

"the reamer specialists"

LAVALLEE & IDE, INC.

CHICOPEE, MASS.

INDICATE A-4-179-2

watch your
production curve
ZOOM UPWARD
with the use of

LAPOINTE -BROACHES
CARBIDE TIPPED

Today's remarkable chatterless broaching speeds, on Lapointe Broaching machines, make possible the use of carbide-tipped broaches . . . usually with phenomenal success in boosting production. That was the experience in one large automobile plant, using those *good* carbide-tipped Lapointe broaches, shown here mounted on a double ram horizontal broaching machine. They are broaching automotive main bearings in "clusters" of five.

Carbide-tipped broaches are used on intricate "pine-tree" forms, as well as on flat slab type broaches. Sometimes carbide is used only on the finishing section of the broach.

New booklet available
"HOW TO CARE FOR BROACHING TOOLS"
Profusely illustrated, it is a complete manual describing the proper care of broaches while in use on the broaching machine and in handling broaches throughout the plant, as well as giving many helpful tips on regrinding of broaches.
Ask for Booklet No. 1

THE LAPOINTE MACHINE TOOL CO.
HUDSON, MASSACHUSETTS — U. S. A.
In England, Watford, Hertfordshire
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

LAPOINTE-BROACHES, *Electrolized* increase broach life between grinds from 2 to 10 times.

LAPOINTE
known to be the best in
BROACHING

cycling controls are available.

A deep over-capacity reservoir is provided to maintain maximum cooling and eddy-free oil flow. A sight-level oil gage is incorporated.

The standard press, which is supplied in four capacities, of 300, 170, 125, and 65 ton, has these specifications: Platen

dimensions are 26¾ x 32 in.; daylight opening is 25 in.; opening rate is 2.7 in. per sec. or 130.2 in. per min.; closing rate is 1.55 in. per sec. or 93 in. per min.; stroke is 12 in.

Sold by A. Dale Herman, Inc., Encino, Calif. **T-4-1801**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

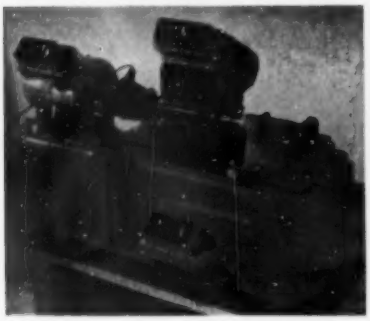
Optical Measuring Unit

Contours of 3-dimensional cams can be checked to tolerances as close as 0.00005 in. with the Alexander universal optical measuring machine. This machine records rectangular coordinate dimensions and controlled rotary movements simultaneously. It also is adaptable for the checking of gears, threads, length measures and gap gages.

The ram, on which the measuring stylus is mounted, moves transversely, and carries a glass scale marked in 0.05-in. divisions which are projected to vernier graduations on a screen reading to 0.005 in. Final readings are taken from an optical micrometer graduated to 0.00005 in. The stylus head ram is mounted on a carriage which also moves along a longitudinal slide. An optical projection system provides screen readings of longitudinal incre-

ments. A 3-position lever permits free movement along the slide, controlled movement by means of a handwheel, or stationary, locked position.

Third measuring element is a standard Alexander P. G. optical dividing head located in front of the ram head and parallel to the head slide. Angle of rotation may be read to 0.1 minute on a projection screen. Alternate locating of the dividing head to the front of the machine permits measuring of



flat cam profiles by an extended stylus.

To measure pitch of threads, gap gages and length bars, and steep slopes of cams, a stylus head allowing a limited lateral float to the stylus is available. This movement is indicated on a 0.0001 in. dial comparator. Five interchangeable ball stylii, ¼, ⅜, ½, ⅝ and ¾ in. are standard.

Sold in the U.S. by J. Arthur Deakin & Son, 150-28 Hillside Ave., Jamaica 32, N. Y. **T-4-1811**

Turret Tool Posts

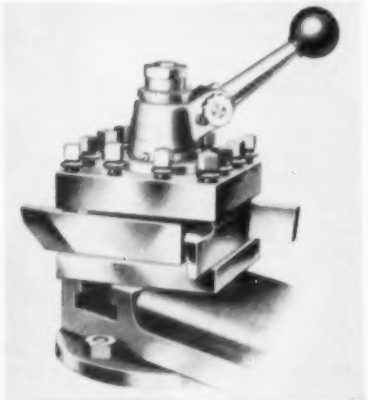
Clamping type handle for these turret tool posts assures positive locking and enables the turret to withstand vibration even when handling interrupted cuts or the fast lathe feeds and speeds.

Raising the handle from horizontal position to about a 45-deg angle clamps a locking collar tightly around the center column of the turret with a cam action that locks the turret rigidly. Only hand pressure is required.

Lowering the handle slightly unlocks the turret, permitting it to be rotated freely to any of 12 indexing positions to bring the required tool for the next operation into proper position.

Turrets with this clamping type handle are available in three standard styles for mounting in the T-slot of the compound rest or the bolt circle of the main slide.

McCrosky Tool Corp., Meadville, Pa. **T-4-1812**



Radius Dresser

Three sizes of Mighty Midget radius dressers for up to 14, 20 and 24 in. diameter grinding wheels provide capacity from 5 in. concave to 2 in. convex radii. To minimize chatter, these radius dressers are unusually heavy, ranging from 20 to 22 lb. Because of the lever-action handle they handle easily.

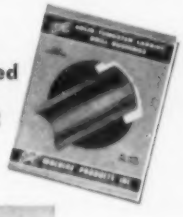
These dressers have a ¾ in. hardened, spring-loaded spindle, riding in a honed bearing that is adjustable for

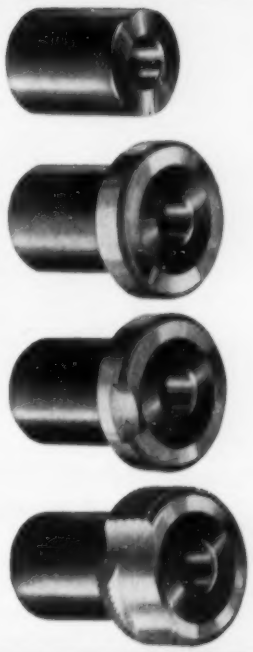
S&E solid carbide drill bushings

A.S.A. Standard
fully interchangeable with Standard Steel Bushings

S & E bushings are precision ground and lapped to exacting finish and tolerance, yielding the highest bushing performance with long life, (more than 50 times the life of steel bushings). This in turn cuts down-time to a minimum, increases tool wear life and provides the users with the highest quality bushing at the lowest production cost.

Ask for illustrated bulletin No. 102





S&E MACHINE PRODUCTS INC.
Plant and General Offices: Bridgeport, Michigan
Sales Offices in all Principal Cities

THIS PRODUCT DESCRIBED IN ASTE DATA SHEETS

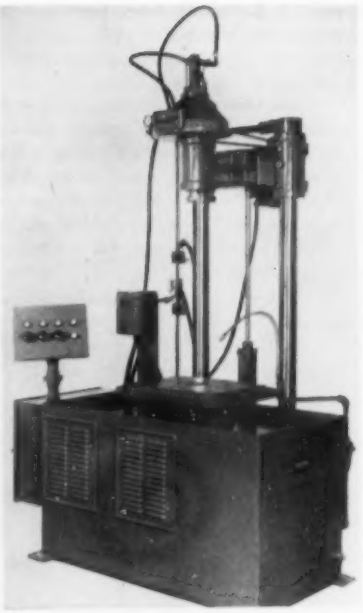
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-181

wear. All surfaces are ground parallel or square from the bearing hole, to insure accuracy. Fully adjustable, stops permit the radius to be stopped at any point from 0 to 180 deg. The dressers work underneath the wheel so there is no necessity to remove the wheel guard.

Sperman Metal Specialties, 2199 E. 21st St., Brooklyn 29, N. Y. **T-4-1821**

Vertical Honing Unit

A vertical type production honing machine has a capacity up to 4 in. diam and 12 in. in height. Speed of the V-belt driven spindle is infinitely adjustable from 225 to 550 rpm by means of a knob on the drive head. Adjustable limit switches control and set stroking lengths. Jogging switches on the control panel permit working in any desired section of the part without resetting the limit switches. The honing cycle is controlled by an electronic timer adjustable within a range of 6 to 120 sec.



The table is adjustable for squareness. The driving head, mounted to the bars with bronze bushings, is hydraulically controlled. Stone pressure is controlled and set by a regulator valve and pressure dial. The integrally-sealed driving head spindle bearings require no lubrication.

A 440/220-110 v machine tool transformer is provided. Current to all switches and controls, other than the three motors, is 110 v.

Superior Hone Corp., 1612 Elreno St., Elkhart, Ind. **T-4-1822**

Drilling Machine

On this automatic cross-drilling machine, multiple operations can be performed rapidly by four horizontally mounted drill heads, located on a common plane and pivoting around the axis of the workpiece through an arc of 270 deg. Feed movements are hydraulic powered.

A simple 4-position rotary drum switch controls sequence of operation of the heads. Thus, complete operating cycles can be set up or changed rapidly. Control of the four heads is interlocked to prevent drill interference.

Able to perform at high speed, heads operate in a preset sequence for cross-drilling, but can also operate simul-

GREIST **MICRO-SCRIBERS®**
mark hard metals fast!

Now in 2 sizes... Heavy-Duty and Slim-Line

Solid carbide tip stays sharper, longer! Scribes fine lines on hardened steel, ceramics, plastics, gems, glass.

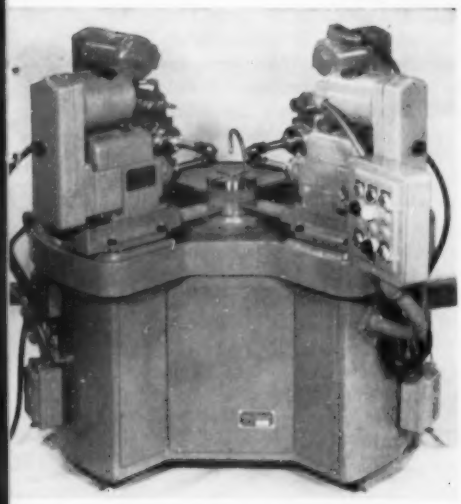
Diamond lapped to correct tip angle that gives you fast, easy, close-tolerance layouts.

Hexagonal aluminum body—anodized for extra protection. Packaged in clear "plastic bubble" that protects precision tip.

Order a half-dozen from your Greist distributor today! Specify **Heavy-Duty** or **Slim-Line.** Only **$1.00** each.

THE **GREIST** MANUFACTURING COMPANY
446 Blake Street, New Haven 15, Connecticut
Precision Products since 1871

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-182



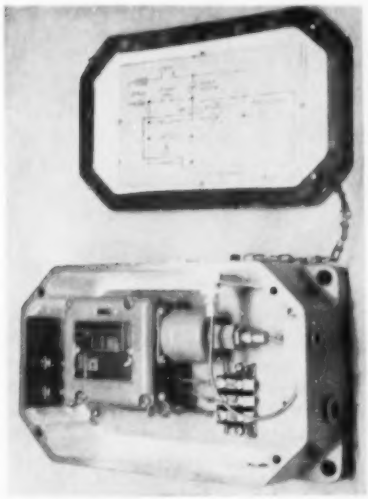
taneously when holes do not intersect. Through-drilling can be performed by one head, followed immediately by reaming with an opposed head. In the same cycle, the workpiece can then index 90 deg for counterboring and chamfering with the other two opposed heads.

Russell T. Gilman, Inc., Grafton, Wis.
T-4-1831

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Lubrication Safety Device

A package unit called Cyclesafe is designed to assure protection against failure of automatic lubrication equipment by stopping machinery when lubrication pressure drops below a predetermined setting. Important feature of the unit is that the machinery completes the working cycle before stopping, thereby avoiding tool, cutter, die



. . . the two-way answer to fastening problems

Here's a combination that slashes production costs and gets rid of fastening problems in a hurry—Milford Rivets made to high-quality standards to assure a better finished product for you . . . Milford automatic rivet-setting machines that can be quickly adapted to your particular fastening needs.

To improve product appearance and strength
. . . to take full advantage of automatic assembly
. . . to cut delivery time and production costs
—get in touch with Milford first!

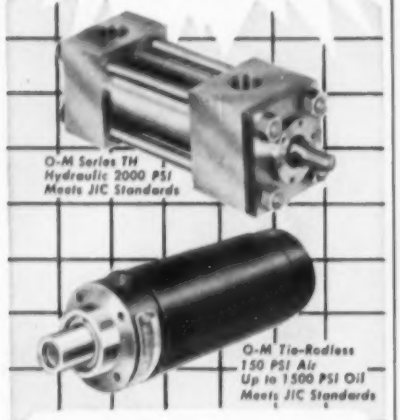
THE MILFORD RIVET

MILFORD RIVET & MACHINE CO.
MILFORD, CONNECTICUT • HATBORO, PENNSYLVANIA
ELYRIA, OHIO • AURORA, ILLINOIS • NORWALK, CALIF.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-183

O-M cylinders
(AIR AND HYDRAULIC)

are an integral part of AUT O-MATION



Look for the big O-M in Aut-OM-ation! Today's high speed Automation Program demands high quality, dependable Air and Hydraulic Cylinders—Cylinders able to maintain today's pace with a minimum of attention. This is why you'll find more and more O-M Cylinders right in the middle of Aut-OM-ation.

O-M Tie-Rodless Cylinders (Round Line)—150 PSI Air—Up to 1500 PSI Oil—Compact in design "To Fit Where Others Won't"—with the lowest co-efficient of friction and easily serviced when necessary. Versatile mounting and port orientation.

O-M Tie-Rod Cylinders (Series "TH")—2000 PSI Oil—Equipped with removable rod gland cartridge for easy maintenance. The modern improved version of the square, tie-rod cylinder, designed to give the best in performance.

All cylinders available in full range of sizes (1½" through 8" bores) with standard and heavy-duty piston rods.

Mail coupon today for Bulletins 101A and 105

ORTMAN-MILLER MACHINE CO.
13 143rd Street, Hammond, Ind.

☐ Have representative call
☐ Send Bulletins 101A and 105

Name _____ Position _____

Company _____

Address _____

City _____ Zone ____ State _____

INDICATE A-4-184-1

or knife damage or breakage. The machinery cannot then be restarted until the pressure has been restored.

The unit contains standard electrical connections, conforming to JIC and NMTBA standards. The Cyclesafe unit is easily mounted on any type present machinery and is completely tamperproof.

Seneca Falls Machine Co., Seneca Falls, N. Y. **T-4-1841**

Double-Cut Snip

Compound lever aviation type double-cut snip features a lower blade which is ground to a triangular reamer point for making the starter cut. There is no need for a punched or drilled starting hole.

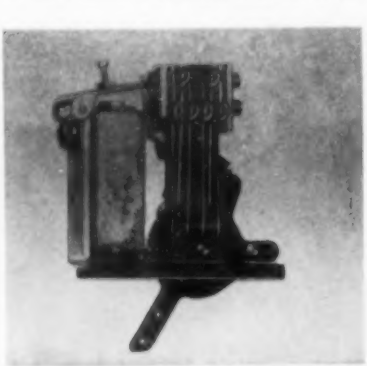
Cutting is easy because of powerful leverage. The blade design avoids binding and permits trimmings to curl free. Female blade is serrated to minimize back thrust.

The Peck, Stow & Wilcox Co., Southington, Conn. **T-4-1842**

Lever Switch

Compact, electromagnetically-latched lever switch is so designed that after the electromagnet has been operated the switch lever cannot be released inadvertently.

This lever switch locks by means of a latch actuated by the armature of an electromagnet which is an integral part of the switch. The electromagnet is energized suitably at the proper point of the sequence of circuit operation. After the electromagnet has been operated, the switch lever cannot be released unintentionally by shock up to extremely large values, or through error.



The switch is available in any contact arrangement required up to a maximum of three make-and-break contacts in the standard arrangement. The contact pressures are very high, and are limited only by the pressure which can be sustained by contact material used.

The standard switch is 2⅝ in. long, 2 in. high, and 1⅜6 in. wide. It weighs approximately 2¾ ounces. Standard operating voltage is 24 v dc.

Customer Service Dept., Jaidinger Mfg. Co., 1921 W. Hubbard St., Chicago 22, Ill. **T-4-1843**

Cleaner for Aluminum

Identification inks, grease, oils and other heavy soils can be removed from aluminum with nonfoaming aluminum cleaner No. 164. It will clean properly with or without agitation.

Used at 6 to 8 oz per gallon of water, at temperatures between 160 and 180 F, solutions do not damage aluminum and its alloys.

Oakite Products, Inc., 158 Rector St., New York 6, N. Y. **T-4-1844**

Surface Grinder

Horizontal, vertical and multi-angle grinding are provided for in the same basic machine with a rigid turnabout column which rotates 180 deg and makes the vertical and horizontal heads quickly interchangeable. The grinder becomes multi-angular by mounting a universal head on either side.

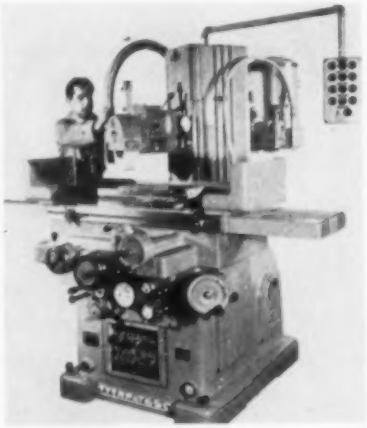


Table sizes of the Zocca Quick-Change grinders range from 12 to 48 in. in width and 24 to 360 in. in length.

Automatic movements of feeds and speeds are hydraulically-driven. The unit can be used for all variations of die and toolroom grinding as well as production grinding, including dovetailing, V-way and bed-way grinding, as well as straight surface grinding. The universal head makes it capable of grinding any angle from 1 to 180 deg., forward and back, left and right.

Downfeed of the wheelhead, controlled independently, is infinitely adjustable with a range of from 0.0002 to 0.0025 in. per longitudinal stroke of the table. The table, with progressive speeds from 3 to 100 fpm in each direction, is hydraulically-driven.

New Equipment Div., S. & S Machinery Co., 140-53rd St., Brooklyn, N. Y. **T-4-1851**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Ratchet Wrench

This one-piece, open end roller ratchet wrench, designated Cam-Loc, will fit over badly burred or heavily painted nuts. Spring expansion allowed behind the special precision-made steel rollers provides equalized torque and an unusually tight grip.

Cam-Loc wrenches have universal use and are especially designed for all tube

fittings, soft aluminum, brass or plastic nuts and bolts, turn-buckles and connectors which may require an open end plus high-speed features of quick, ratcheting action.

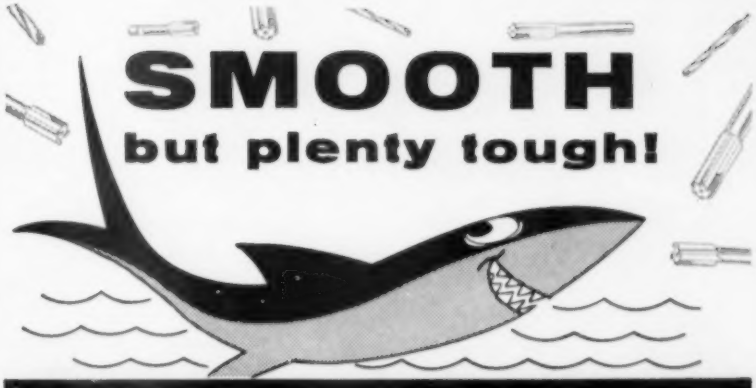
Due to the tool's short ratcheting arc swing, it operates easily in confined and hard-to-reach places.

T.K.F. Co., Fisher Bldg., Detroit 2, Mich. **T-4-1852**

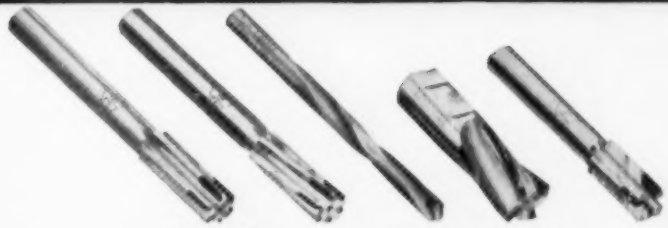
Grinder

This precision Johansson grinder is available in two types: the 2P for production and the 2U for toolroom and production use. Center distances are 40, 60 and 80 in., and the swing over table is 14 in.

The universal type takes grinding wheels of 20 in. diam and up to 3-in. width; the production model takes up to 30 in. diam and 4-in. width. Table travel is up to 236 ipm. Maximum di-

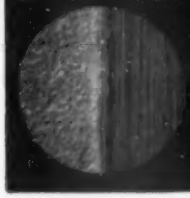


WENDT-SONIS tools cut fast and clean . . . stay sharp

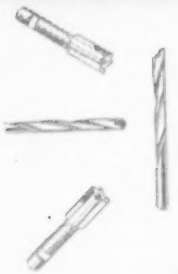


Flo-Finish, an extra process applied to Wendt-Sonis tools after grinding, improves smoothness 30% over ground finishes, permits faster feeds and speeds.

Micro-photograph (below) shows how Flo-Finish (left) eliminates grinding marks (right).



Flo-Finish makes stepped-up production possible because the smoother flutes on round tools permit faster chip flow away from the cutting edges. Tool life is doubled in some applications, because there is less chip friction, less heat.



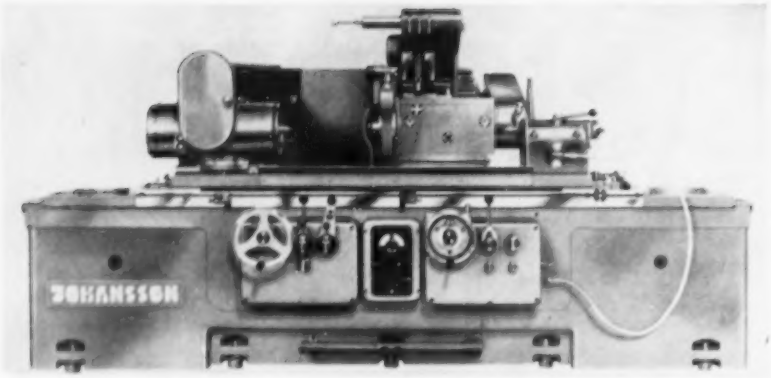
Flo-Finish is applied to reamers, counterbores, end mills, twist drills, core drills and all other Wendt-Sonis round tools at no extra cost. You save when you use these Wendt-Sonis tools that are extra-smooth, extra-tough! Technical advice on the use of Wendt-Sonis tools is available through your distributors' salesmen.

Send for Catalog No. 55 — Address Dept. TE-457

WENDT-SONIS COMPANY

Hannibal, Missouri • Rogers, Arkansas

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-185



ameter in chuck is 7 in. and in collets is 1½ in. The headstock is gearless. Twelve speeds range from 20-320 rpm.

The wheel head swivels to allow simultaneous diameter and end-face grinding with profiled wheels. The headstock can be rotated through 360 deg and can be used at either end of the table. Manual and automatic feeds can be operated simultaneously.

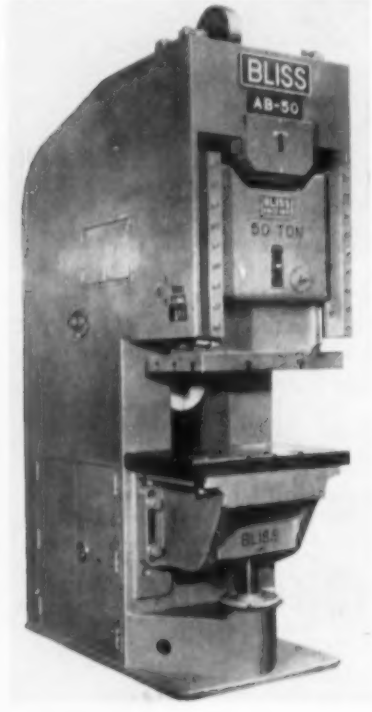
Engineering Dept. Homestead Inc., 9 Addison St., Larchmont, N.Y. **T-4-1861**

Adjustable Bed Presses

A line of adjustable bed presses, featuring a fully enclosed box type frame, offers capacities ranging from 50 to 150 tons. Their design incorporates a box crown, box slide, and complete enclosure of all controls. Air controls and recirculating oil unit are enclosed on the left-hand side of the press; the press and motor controls are similarly flush-mounted on the right-hand side. Other features include a fast-acting air friction clutch and brake, an adjustable rotary limit switch, and bronze-bushed bearings at the frame, connections and gibs.

The 18 by 24-in. bed of the 50-ton model (illustrated) can be raised or lowered a distance of 9 in., making possible a shut-height adjustment from 11 to 20 in. The units also are designed for economy of floor space; the 50-ton model is 37 in. wide and 74 in. front-to-back.

E. W. Bliss Co., Canton, Ohio.
T-4-1862



USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Power Saw

Low-cost, heavy-duty power saw, Model C-12, built to utilize Demon high-speed steel saw bands, has a work capacity of 12 x 12 in. Setup and operation are simple, adapting the machine to shops or departments where operators will be using it for individual cut-off jobs.

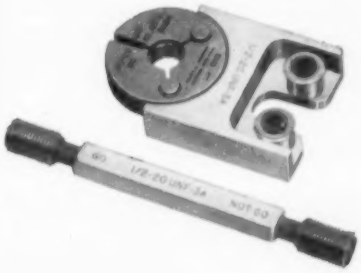
Accuracy of cut on the C-12 is 0.002 per inch of diameter; typical cutting rates are under two minutes for a 5-in. round of mild steel, five minutes for a 3½-in. square of 18-8 stainless, 19 minutes for an 11¾-in. round of oil hardening tool steel.

Hydraulic band tension makes optimum band tension automatic, thus simplifying machine setup. The sawing head of the Model C-12 is of sufficient size and weight to provide the required feeding pressure through gravity. This hydraulic system also is used to control the feed and to raise the sawing head. An hydraulic valve, set in the feed position, provides a calibrated, adjust-

. . . AND FOR YOUR THREAD-INSPECTION JOBS BEST HANDLED BY P&W CONVENTIONAL GAGES . . .

"GO" and "NOT GO" RING GAGES

provide a functional check at maximum metal limit and a pitch diameter check at minimum metal limit.

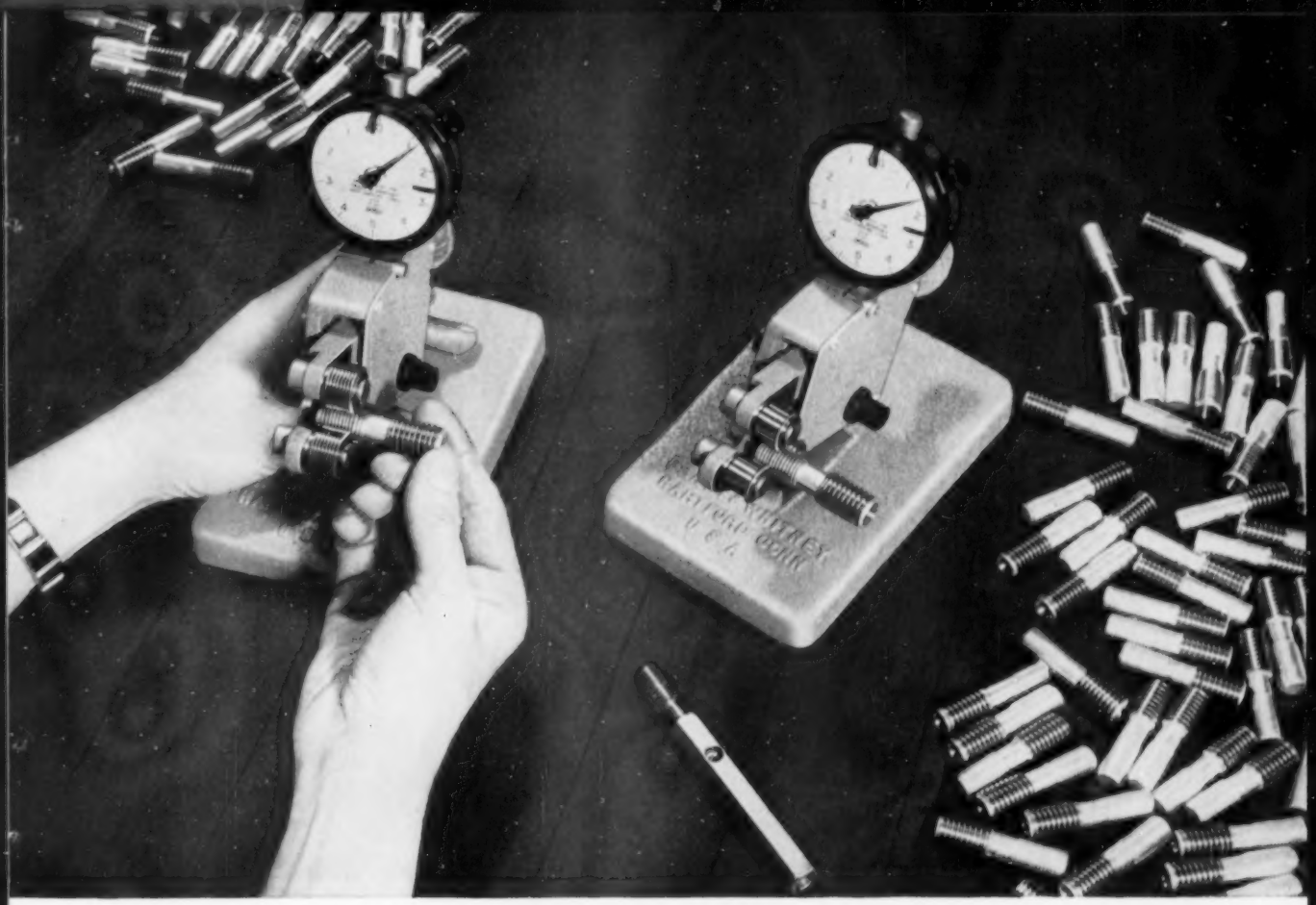


RING-SNAP LIMIT THREAD GAGES

provide a functional check with a "Go" ring at maximum metal limit and an actual pitch diameter check at minimum metal limit with single-rib radius rolls of best wire size.

ROLL THREAD SNAP GAGES

provide a functional check with multiple-rib "Go" rolls at maximum metal limit and a pitch diameter check at minimum metal limit with 2-rib "Not Go" rolls.



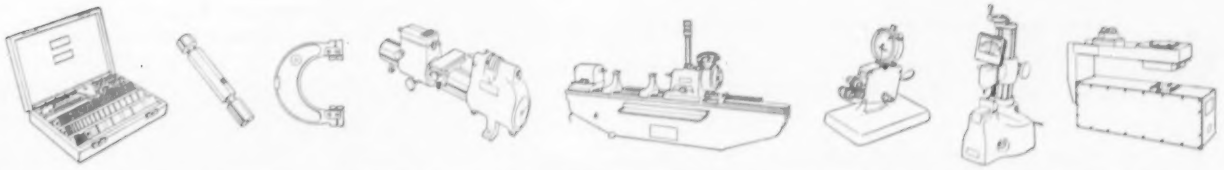
CHECK CLASS 3 and 3A THREADS *on a Production Basis*

. . . QUICKLY, DEPENDABLY AND ACCURATELY WITH A P&W TRI-ROLL THREAD COMPARATOR

Here for the first time is a *production gage* that duplicates the precise 3-wire thread measurement method. Equipped with single-rib rolls, the P&W Tri-Roll Thread Comparator provides this *critical check at actual pitch diameter* which is essential in producing threads to meet Class 3 and 3A standards. Equipped with interchangeable full-length rolls, it also provides a *complete functional check* . . . detecting "drunken lead" and deviations in lead, roundness, angle, and pitch diameter.

Today, a greater demand is placed on you for higher precision. A fast-growing percentage of threads must now be produced to meet Class 3 and 3A standards. Be sure your quality control methods are geared to keep pace with this growing demand . . . efficiently and profitably. Write now for complete information on P&W Tri-Roll Thread Comparators.

Pratt & Whitney Company, Incorporated,
16 Charter Oak Boulevard, West Hartford, Conn.



GAGE BLOCKS . . . CONVENTIONAL GAGES . . . SUPERMICROMETERS . . . STANDARD MEASURING MACHINES . . . COMPARATORS . . . AUTOMATION AND CONTINUOUS GAGES

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

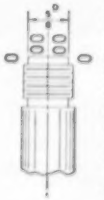
MACHINE TOOLS • GAGES • CUTTING TOOLS

The Lepel line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating.

If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

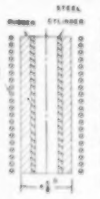
TYPICAL INDUCTION HEATING APPLICATIONS

HARDENING
DIESEL FUEL INJECTOR

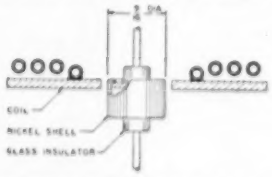


Restriction of heat to end of holder body for fuel injector permits hardening of face to provide required resistance to deformation without hardening the threads. Coil design shown provides uniform temperature for hardening despite holes in face.

REMOVING
RUBBER FROM STEEL



Induction heating develops uniform temperature at steel-rubber interface destroying bond for easy separation. Steel and rubber may similarly be salvaged from mounting brackets, shock absorbers, etc.



SOLDERING TRANSISTOR ASSEMBLIES

Concentrator-type coil creates high intensity, restricted heating at joint of nickel shell and tinned glass, thus causing solder flow for permanent seal.

Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

'WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.'

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

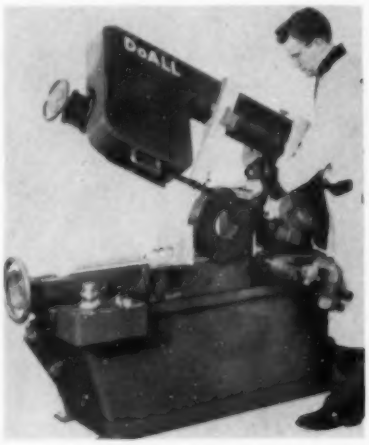
LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-188

able orifice which permits selection of any feeding rate down to 0. A solenoid-operated hydraulic lock is incorporated in the hydraulic circuit. When power is interrupted, the head is automatically locked in position, preventing damage to the saw blade.

The Model C-12 power saw uses a saw band 1 in. wide and 129½ to 132 in. long, which is powered by a 1½ hp motor through four step cone pulleys giving blade speeds of 90, 125, 180 and 250 fpm.

Reservoir for recirculating coolant system is built into the base of the machine. The coolant nozzle completely surrounds the saw table, coating it and flooding the work with coolant. A screened chip drawer is provided for easy disposal of chips.



The machine can be equipped with a 10-ft loading conveyor. It also may be powered so that the 12 rolls are chain driven for handling heavy work.

The DoAll Co., Des Plaines, Ill.

T-4-1881

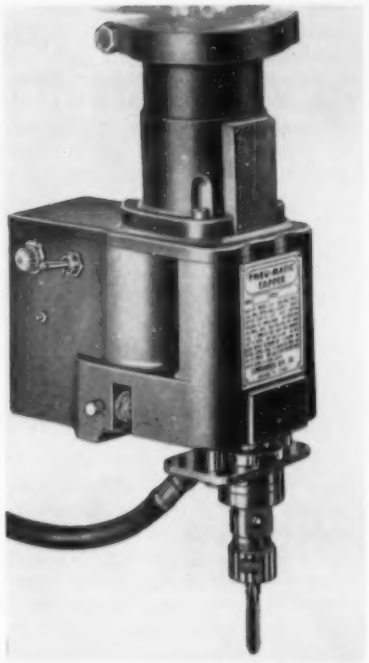
Pneumatic Tapper

High-speed, automatic air-actuated tapping head with adjustable torque control may be mounted on any drill press. The multipurpose unit, called the Pneu-Matic tapper, is designed for general-purpose or precision tapping.

Precisely adjustable control of spindle approach and tapping depth insures fast, safe, accurate tapping. Preset cycle is repeated each time foot, fixture or hand switch is actuated.

A cycle interruption switch gives the operator absolute control of the unit. When this switch is thrown anytime during the tapping cycle, the tapper immediately returns to the top position and stops until the start switch is actuated again.

The tapper accommodates tap sizes up to ¾-16. Adjustable torque control



protects taps. Conversion to lead-screw tapping can be accomplished by replacing the main spindle drive assembly with a standard Commander lead-screw assembly. The tapper operates on shop air pressure and 115 v a-c.

Commander Mfg. Co., 4225 W. Kinzie St., Chicago, Ill. **T-4-1891**

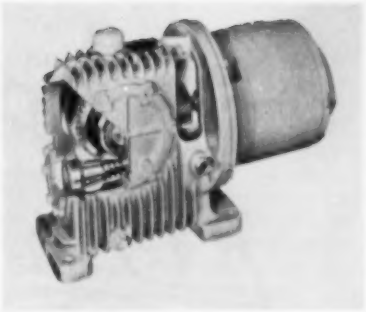
USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Die-Casting Unit

High-pressure, cold-chamber die casting machines, available in 200, 400, 600 and 800-ton capacities, incorporate clamp link-wedge locking mechanisms, plus extra-heavy platens and tie rods to lock and preload dies to rated tonnage. The heavy central screw adjustment is motorized and has push-button operation for quick die setup and tonnage control. Compact design of the injection end and the hydraulic circuit, which utilizes special valves and controls, minimize "cut and try" on gates, vents and overflow. Maximum plunger speeds and positive pressure follow-through from the pump, minimize porosity problems, and surface finish and "fill" difficulties.

Pressures and press cycle controls are designed for recording so repeat setups can be made.

The Hydraulic Press Mfg. Co., Div. of Koehring Co., Mount Gilead, Ohio. **T-4-1892**

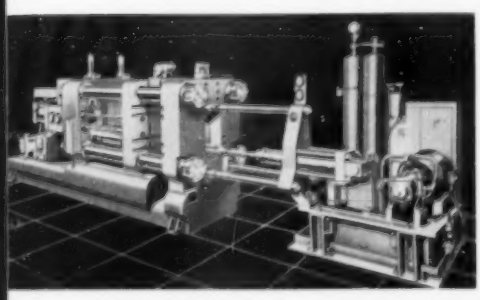


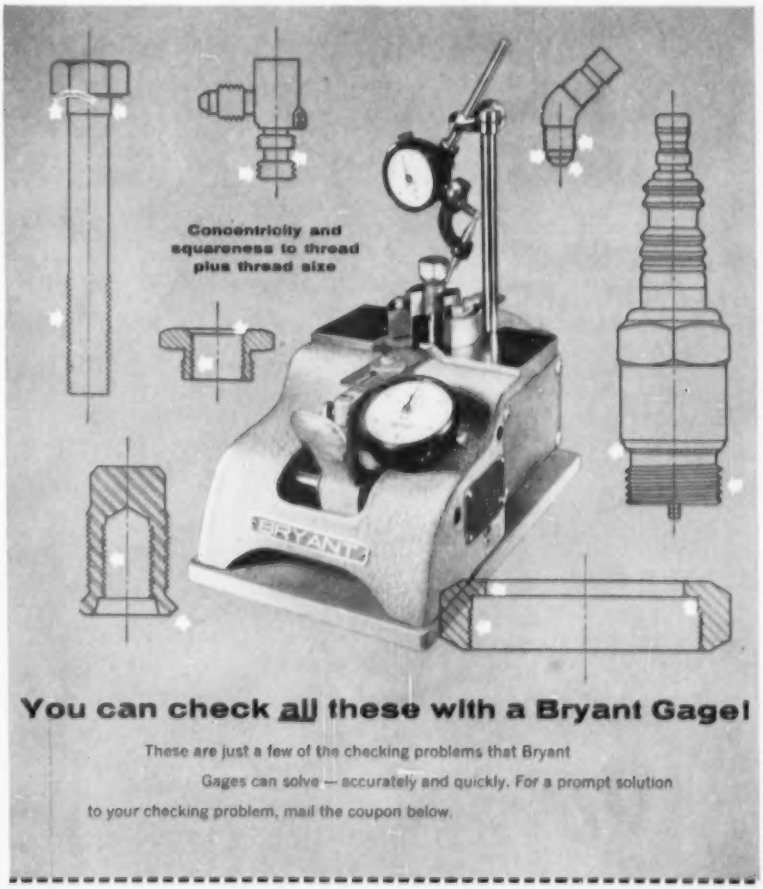
Worm Gearmotors

Double-enveloping worm gearing provide compactness, high capacity and long life for these right-angle worm gearmotors available in standard extended shaft and shaft-mounted models.

Standard NEMA D-flange motors are used and gearmotors are available with or without motors. Four different sizes are currently available to handle fractional to 15-hp motors. All gearmotors are available in 28 standard output speeds from 6.25 to 525 rpm.

The gearmotors are double-reduction units with a double-enveloping worm-





You can check all these with a Bryant Gage!

These are just a few of the checking problems that Bryant Gages can solve — accurately and quickly. For a prompt solution to your checking problem, mail the coupon below.

Bryant Gage and Spindle Division P. O. Box 620-J Springfield, Vermont, U. S. A.

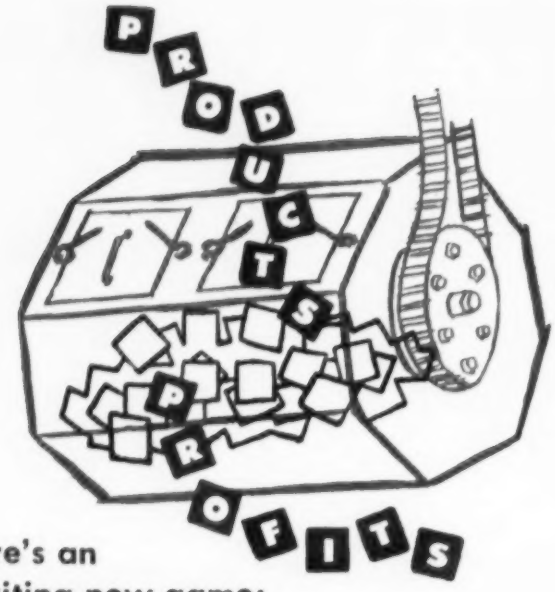
Gentlemen: ☐ I am enclosing a print of my part. Please send me a quotation. ☐ Please send literature and prices on the complete line of Bryant Gages. ☐ Please have Bryant representative call.

Name _____ Street _____

Title _____ City _____ Zone _____

Firm _____ State _____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-189



Here's an exciting new game:

PUT your products in the barrel
TAKE your profits out

One of the greatest money-saving opportunities in metalworking lies in the use of barrels to finish parts by the hundreds in place of conventional methods that finish one part at a time.

Barrel finishing makes easy work of many tough jobs of grinding, deburring and buffing by wheel.

One Oakite customer changed to barrel methods to deburr curved stainless steel strips that are 14 inches long. The cost for deburring 20,000 strips was reduced from $3,000 to $125.00.

FREE For a copy of *"Precision Barrel Finishing"* —containing valuable information on cutting down, deburring, descaling, and burnishing—write to Oakite Products, Inc., 58 Rector Street, New York 6, N. Y.

OAKITE
Export Division
Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada
FOR FURTHER INFORMATION; USE READER SERVICE CARD; INDICATE A-4-190

gear secondary and helical primary to provide high load-carrying capacity on small center distances.

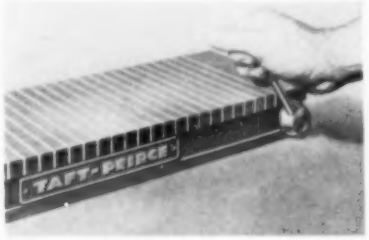
Neither ratio nor number of teeth affects the total contact area or strength of the gearing. All teeth within an arc of 45 deg on the gear are in simultaneous contact with threads on the worm.

Cone Drive Gears, Div. Michigan Tool Co., 1171 E. McNichols Rd., Detroit 12, Mich. **T-4-1901**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Permanent Magnet Chuck

Complete all-over holding power is provided by this Model 824 permanent-magnet chuck featuring unusual faceplate construction. Special Alnico V chuck design avoids dead spots and provides full edge-to-edge usable surface. A special epoxy resin, nonmagnetic separator material provides extra faceplate stability and makes the chuck considerably lighter.



Height of the Model 824 is only 2⅞ in.; work surface is 8 x 24 in.; magnetic surface is 168 sq in. The unit weighs only 110 lb.

The Taft-Peirce Mfg. Co., Woonsocket, R. I. **T-4-1902**

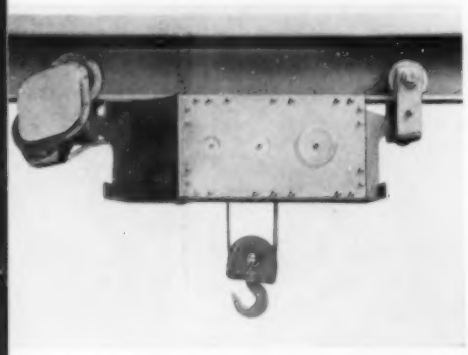
Heavy-Duty Hoists

Hoists, in capacities from 3 to 15 tons, offer load control to within 0.008 in. Low headroom requirements result from the flat-lying U-shape arrangement of the motor, gearbox and drum. The motor and drum are parallel-mounted on the same side of the gearbox, permitting the load block to retract between them. Thus, with a trolley-mounted hoist of from 3 to 7½-ton capacity, the distance between rail and load-carrying eye of hook measures only 21 in.

Compact and light-weight in design, the hoists are built for all-weather operation and are available with plain trolley, hand-geared trolley, motor trolley, deck, lug and hook mountings.

Precise load control is achieved through instant torque of the motor and

use of two braking systems. Regenerative braking (with no parts to wear and requiring no adjustment) automatically regulates load travel to controllable speeds. Oversize electromechanical brakes are used to stop capacity loads

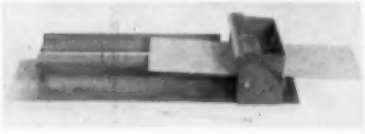


quickly. Either brake system will adequately handle a load up to 150 percent of rated capacities.

R.G. LeTourneau, Inc., 2399 S. MacArthur, Longview, Texas. **T-4-1911**

Strip Feed Lubricator

This strip feed lubricator for punch press operations works with either continuous coil stock or random length pieces. It wipes the surface of the stock, and places a thin even film of lubricant on either or both sides of the strip stock. This is accomplished through means of an upper and lower oil reservoir, and two floating felt wipers. A ball-bearing



mounted roller with polyethylene surface deposits oil on the lower side of the stock, and the felt wiper removes excess oil.

This lubricator can be mounted in position quickly and requires minimum maintenance, and it often pays for itself within the first two days of operation. It reduces labor cost, increases die life, and improves the quality of many punch press products.

Automation for Industry, Port Crane, N. Y. **T-4-1912**

Drafting Table

Entire base, including drawers, of this 4-post drafting table is made of steel. Tops consist of solid basswood panels with heavy-gage steel end cleat.

Steel legs and side rails are of welded construction. A leveler on each leg permits the table to be set level on the floor.

The tables are available with any of five combinations of tool or shallow drawers. Inside dimensions of the tool drawer are $3\frac{3}{8}$x$10\frac{1}{2}$x$24\frac{1}{2}$ in. Shallow drawer dimensions are $1\frac{15}{16}$x26 in. depth for tables No. 7744 through No. 7747, and a 33-in. depth in tables No. 7748 and No. 7749. Width of the drawer depends upon the size of the table.

Table also is available in a drawing top and reference top combination which has over-all dimension of $37\frac{1}{2}$x72 in. The drawing surface is $37\frac{1}{2}$x48 in. and the reference surface is $37\frac{1}{2}$x24 in.

Mayline Co., Inc., Sheboygan, Wis. **T-4-1913**

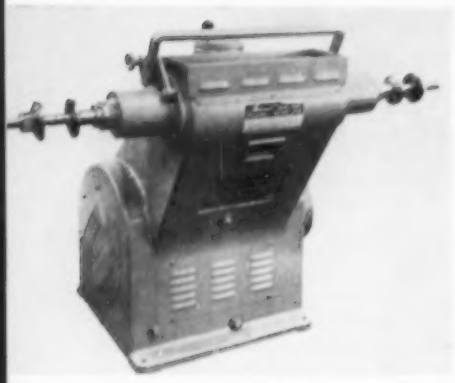
Polishing and Buffing Lathe

Model VRO variable-speed polishing and buffing lathe is now available with a special braking bar which can be actuated from either side of the lathe.

Spindle speed of this heavy-duty machine is infinitely adjustable between 1500 and 3000 rpm and may be changed quickly by turning the speed dial mounted on top of the machine.

The variable-speed feature makes it possible to use the most efficient spindle speed for each type of operation. As brushes and buffs wear down, the spindle speed is correspondingly increased,

First Showing!
KNIGHT'S
NEW NO. 60
Metalworking's most accurate, fast and
VERSATILE VERTICAL
PRECISION BORING...and MILLING
• Unusual extra capacity
• Solid table support
• Choice of 3 measuring devices
• Big heavy bed-type table
• Extra cross & vertical travel
• Easy simplified operation
Send for brochure
ATTACH TO COMPANY LETTERHEAD
TWO TABLE SIZES
18" x 52"— 28" longitudinal travel
18" x 60"— 36" longitudinal travel
KNIGHT
W. B. KNIGHT MACHINERY CO.
3918 West Pine Blvd. • St. Louis 8, Mo.
W. B. KNIGHT MACHINERY CO.
3918 West Pine Blvd., St. Louis 8, Mo.
Send complete information on new No. 60 Vertical.
Name
Title
☐ Have representative call.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-191

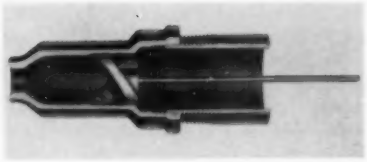


maintaining correct peripheral speed.

Hammond Machinery Builders, Inc., 1661 Douglas Ave., Kalamazoo, Mich. **T-4-1921**

Nozzles for Inaccessible Work

The vane of this Fulljet spray nozzle, designed for mounting in hard-to-reach places, is made with a small female-threaded connection to receive a pull-out rod, to be installed by the user in whatever length required. The rod extends back inside the pipe to some connection point that is easily accessible. When cleaning is needed, the vane is merely drawn back through the pipe, removed and cleaned while the nozzle itself is flushed out.



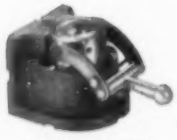
Spraying Systems Co., 3201 Randolph St., Bellwood, Ill. **T-4-1922**

Zagar Tools

HOLD YOUR WORK—AND YOUR BUSINESS!

Collet indexing fixture

Collet holding fixture



Vertical-horizontal collet fixture

ZAGAR HOLDING and INDEXING FIXTURES

Zagar fixtures offer you a most inexpensive way to machine small parts. Set-up is speeded and much special tooling eliminated. Slot milling, straddle milling, drilling, tapping and grinding of small pieces can be done most profitably with Zagar fixtures, *available from stock.*

COLLETS, PADS, BLANKS

Five types: No. 310 Zagar Master; Nos. 2 and 6 W. & S.; No. 5-C; No. 6 W. & S. pads. All but Zagar No. 310 are standard machine tool sizes. All collets are made of oil-hardened tool steel; have flat tops for locating purposes.

★ ★ ★

Ask for Zagar Catalog "E-4"

ZAGAR, INCORPORATED

23892 LAKELAND BLVD. • CLEVELAND 23, OHIO

Zagar

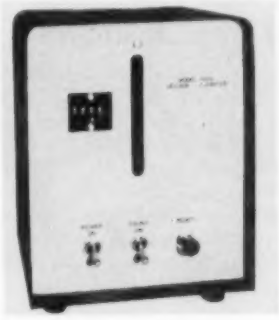
TOOLS FOR INDUSTRY and SPECIAL MACHINERY

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-192

Electronic Counter

A 7-lb portable electronic counter offers both plug-in electronic decade and five-digit mechanical register. Design consists of an input amplifier, pulse shaper, plug-in electronic decade unit and register.

Capable of counting rates up to 12,000 counts per minute the counter will respond to electrical pulses of 2.5 volts



peak, such as derived from a photocell or magnetic pickup, or will respond to ordinary contact closure. Count capacity is 999,999 counts, with an accuracy of ± one count. It operates on 105-125 v ac and has 90 v dc accessory power available for operation of photocells, etc.

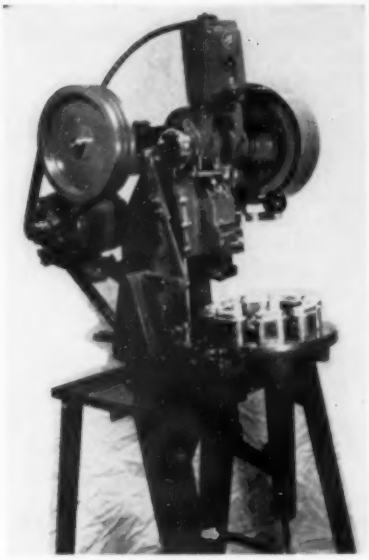
Performance Measurements Co., 15301 W. McNichols Rd., Detroit 35, Mich. **T-4-1923**

Power Press

Steel parts can be marked with up to twelve ⅛-in. characters with this small power press, designated Model S-4K.

Equipped with an 8-station dial feed, this unit is simple and safe to operate. The operator feeds parts; unloading is automatic. Feeding is done at front of dial, a foot from the ram, for maximum operator safety. The press is tripped by means of a hand lever located at a safe distance from ram and dial.

Stroke of the press is ¾ in.; die



space is 6 in.; throat, 4 in. Speed is 60 rpm with back gear. Ram bore is 1 in.

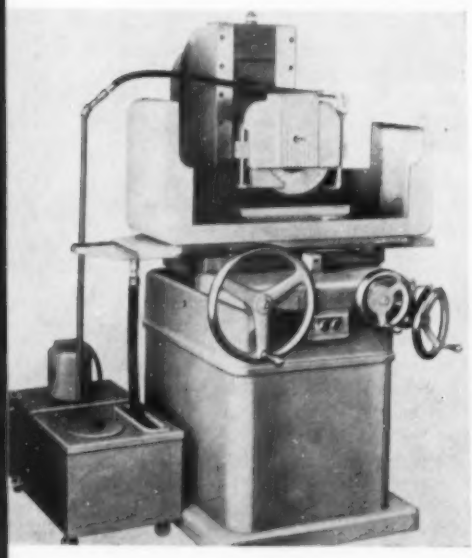
Geo. T. Schmidt, Inc., 4100 Ravenswood Ave., Dept. TF, Chicago 13, Ill.

T-4-1931

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Surface Grinder

Large-capacity, 10 by 16 in. hand-feed surface grinder, designated No. 17, is particularly adapted to dieblock and general toolroom work. It can be quickly set up. Elevating handwheel is located below table level so that surface of workpiece and handwheel graduations are simultaneously in view of



Roto-Finish

processes give you
• tremendous savings
• high production
• uniformity of finish

Savings on deburring, descaling, grinding, polishing, coloring and surface improvement by Roto-Finish barrel finishing processes are tremendous. Expensive hand finishing can be eliminated.

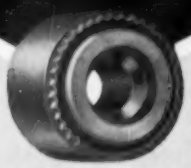
Results Guaranteed ! Send samples of finished and unfinished parts to Roto-Finish. Roto-Finish Sample Processing Laboratories will prove to you — before you buy — that Roto-Finishing will give you the results you want. Furthermore, Roto-Finish guarantees to produce the same results in your plant that are achieved in sample processing.

Let Us Help You with Your Problems

Roto-Finish COMPANY
P. O. Box 988
Phone FI 3-5578
3726 Milham Rd., Kalamazoo, Mich.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE 4-A-193-1

faster • easier • lower cost
Template assembly

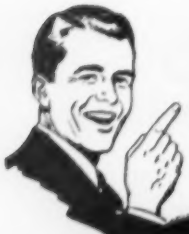


- Drop a PEM self-clinching drill bushing into each on-center hole and squeeze. *Template's finished.*
- No riveting—no welding—no indexing—no nesting—no outboard supports.
- Compression clinching locks bushings securely into template metal.
- True alignment—and center distances—automatically.
- High torque and pullout resistance.
- Pay for themselves in assembly savings.
- Permit thin gauge, light weight templates.

Write for literature, and samples for trial.

PEM
PENN ENGINEERING & MANUFACTURING CORP.
DOYLESTOWN • PENNSYLVANIA

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-193-2



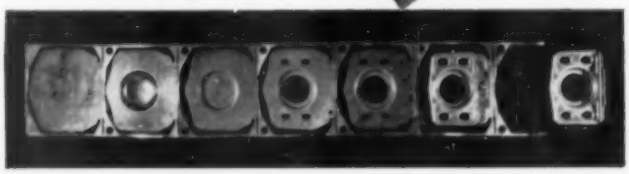
eliminate production operations . . .

Cut Product Cost!

with

B. Jahn

PROGRESSIVE DIES



One of thousands of cost cutting die ribbons — saving industry millions!

"Production Proved" B. Jahn Dies have eliminated costly, unnecessary production operations for many of the world's largest manufacturers.

At the conception of a new product . . . at the design stage . . . explore the possibilities of creating a better product at less cost with the ingenuity and automation built into all B. Jahn Progressive Dies. Perform 12 or more operations with each press stroke on intricate components.

Save time, cut costs! B. Jahn can design, build, production prove, and will run 50,000 components for production line use before shipping your new, time saving, cost cutting B. Jahn Die!

SEND TODAY for new, fact-packed brochure — showing dozens of cost-cutting case histories.

B. Jahn

THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-194

the operator.

The table is actuated by a timing belt drive. Only 2¾ turns of the large-diameter handwheel moves the table the full 16 in.

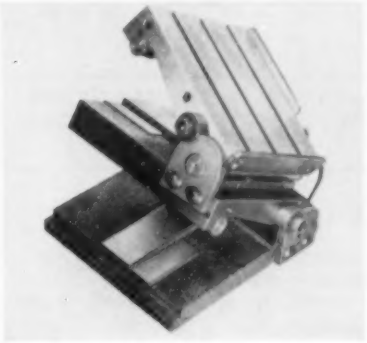
Spindle is grease-lubricated and direct-driven by 2-hp, 1750-rpm motor.

Addition of pump and tank unit converts the No. 17 into an efficient wet grinding machine. Separate motor with direct drive to a centrifugal pump delivers coolant through piping and an adjustable nozzle to the work.

Covel Mfg. Co., Benton Harbor, Mich. **T-4-1941**

Compound Sine Plate

Fast, accurate setups of either compound or single angles are possible with Model 1905 compound sine plate equipped with positive locking devices to keep the unit rigid while in use on machining operations or for checking and inspecting. The bodies are special alloy iron and the rolls are hardened and ground to the same diameter within



0.0001 in. All other dimensions are held to a tolerance of 0.0002 in.

The top plate is 6¼ in. square and provided with three T-slots for holding the work. Heavy-duty end and side plates also are provided. Base and middle plate each have 0.2000-in. recess to facilitate use with small angles.

Dept. TE, Bald Eagle Corp., 356 Cedar St., St. Paul 1, Minn. **T-4-1942**

Centerless Grinder

Tungsten carbides, steels, stainless, plastic, ceramic, glass, hard rubber, carbon, wood, fiber, cork and nonferrous metals can all be ground on the TG-12 Royal Master centerless grinder.

Tolerances of 0.0002 in. are easily achieved and 6-8 microinch finishes are consistently obtained. The grinder handles work from 0.004 to 1½ in. in diameter. It may be used for either plunge or through-feed grinding and can be converted to either. Setup is fast

and easy. Work wheel may be replaced quickly. A hydraulic system is incorporated for automatic cycling and wheel stressing.

Royal Master, Inc., 111 State Hwy. 23, Riverdale, N. J. **T-4-1951**

Air Cylinders

Designed to provide very compact sizes in all strokes, the Toolmor air cylinder gives a full line pressure power thrust with heavy hardened steel piston. Square and parallel sides simplify installation and arrangement of tooling. Universal mounting permits either horizontal or vertical use.

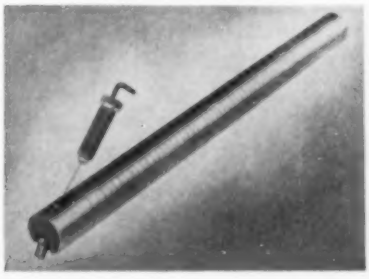
The cylinders are available with standard, ball, swivel, threaded or tool blank piston ends, permitting a selection of tools in various length strokes, beginning with 3/8 in.

Burklyn Co., 3429 Glendale Blvd., Los Angeles 39, Calif. **T-4-1952**

Boring Bar

This "chatterless" boring bar is designed to absorb shock and vibration. It is offered with cutting tool at 53 deg or at 90-deg angle, and micrometer adjustment tool bit. It will also be available with a conventional nonadjustable tool bit. The bar is graduated every quarter-inch to indicate depth of boring.

Modern Mfg. Co., Inc., Edgemont and Clementine Sts., Philadelphia, Pa. **T-4-1953**



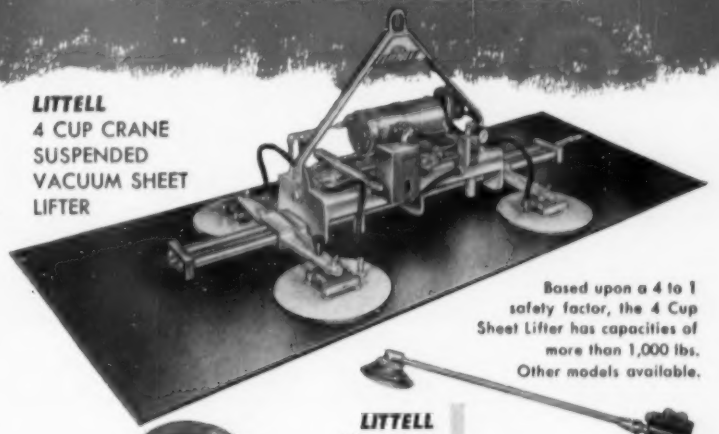
Center Drills

Safety center drills incorporate design features that eliminate the need for deburring operations and reduce the possibility of lathe center damage.

A radial type, for precision work, and heavy duty type for heavier work, are both available in a plain and bell style. The bell type has a top angle of approximately 100 deg before going into the 60 deg angle which deburrs the corner to provide a protective center.

Radial type center drill, D-400R, available in sizes 1 through 8, is ground to a radius to avoid sharp notch area of the plain type which constitutes a fatigue point. The radius design also introduces a back taper to the drill portion, providing tip clearance and minimizing drill breakage. Spiral flutes also prevent jamming. Small contact

LITTELL
AIR VACUUM UNITS
lift • move • handle
SHEETS or BLANKS



LITTELL
4 CUP CRANE
SUSPENDED
VACUUM SHEET
LIFTER

Based upon a 4 to 1 safety factor, the 4 Cup Sheet Lifter has capacities of more than 1,000 lbs. Other models available.

LITTELL
AIR BLAST
VALVES
Automatic ejection of pieces by using a short blast of air permits the operator to give his entire attention to loading the die, thereby saving time and increasing output.

LITTELL
PRES-VAC
SAFETY FEEDERS
. . . operate on a minimum of air—only 45 lbs. psi and handle parts from 2 to 10 lbs.

LITTELL VACUUM CUPS

14" diameter herringbone faced cup with neoprene rubber.▲

Molded on steel backing plate equipped with 4 mounting holes. Other designs for 6 to 10" diameter available.▼

Standard cups in neoprene or gum rubber sizes 3/4" to 5".

Rectangular cups with neoprene rubber molded on steel backing plate. Sizes 2 1/2" x8 3/4" and 3 1/2" x16".

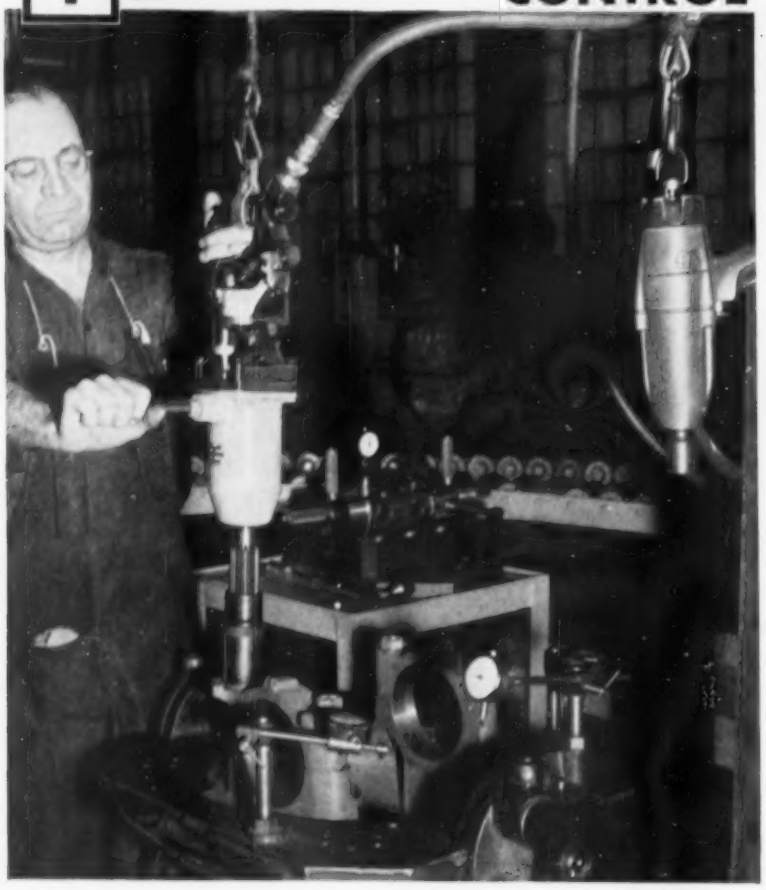
▼As shown in top illustration. ▲ As shown on Pres-Vac. Write for FREE Catalog!

AIR-VACUUM DIVISION
8199 N. RAVENSWOOD AVE.
CHICAGO 13, ILLINOIS

2571C

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-195

I-R TORSION BAR TORQUE CONTROL



TORQUE CONTROL IMPACTOOLS

consistently run nuts to prescribed torques

I-R Torsion-Bar Impactools now assure top quality control on these 3 operations:

1. *Assembling differential main bearing caps at 450 ft. lbs. both before and after machining as shown above.*
2. *Preloading differential drive pinion bearing with Impactools set at 375 ft. lbs.*
3. *Assembling wheels to wheel hubs at 425 ft. lbs.*

Quality control has risen to a new high for this large manufacturer of farm equipment since I-R Torsion-Bar Torque Control Impactools were installed.

These Impactools are the *only* power wrenches that deliver full power and speed until the preset torque is reached, and then instantly and automatically shut off.

Now, with Torque Control Impactools, the company consistently runs nuts to prescribed torques, saves time, improves quality and eliminates hand torque checking operations.

Write for Bulletin 5170 for proof of how these amazing Impactools can improve quality and cut costs on your own applications.

Ingersoll-Rand

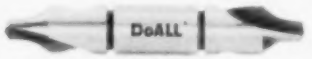
11 Broadway, New York 4, N.Y.

8-524

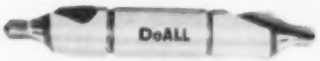
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-196

area of the radial type center drill and large oil reservoir lessen friction.

The D-400S heavy duty type center drill, available in sizes 11 through 18, gives a large contact area for use on heavy parts, while retaining the advantages of the radial type. The drill is



RADIAL TYPE
D-400 R



HEAVY DUTY TYPE
D-400 S

ground with an 82 deg top angle, and effectively deburrs corners. It may be used for drilling and countersinking sheets and plates where flat head or oval head screws are to be used.

The DoAll Co., Des Plaines, Ill. **T-4-1961**

Air Gages

A standard line of multiple-column air gaging instruments afford rapid checking of a number of close-tolerance surfaces simultaneously. As many as eight separate dimensions can be measured with gage response within five-tenths of a second. Stock delivery is

available in standard instruments ranging from two to eight-column multiples.

This Dearbornaire line includes self-cleaning pressure system, complete linearity over the full scale, interchangeable component parts, two-step amplification conversion, and zero-centered scale permitting tolerances to be read as plus or minus from the nominal dimensions.

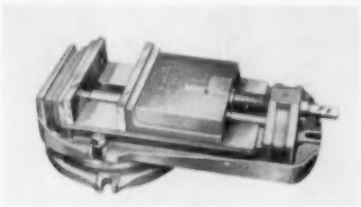
Air Gage Div., Dearborn Gage Co., Dearborn, Mich. **T-4-1962**

Swivel-Base Vise

Line of sturdy swivel-base milling machine, drill press and shaper vises, is designed so that work-holding surfaces are always at true right angles, or

parallel to the table.

The vises are available in three sizes. Jaws of the Mogul are $\frac{5}{8}$ in. thick, $8\frac{5}{8}$ in. wide and $2\frac{3}{16}$ in. deep, and open 6 in. Jaws of the Master are $\frac{1}{2}$ in. thick, $6\frac{1}{2}$ in. wide and 2 in. deep, and open

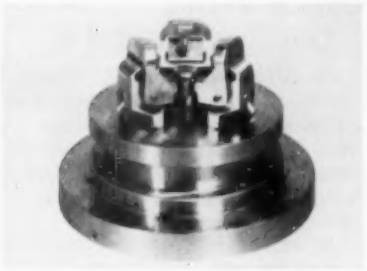


4 in. Jaws of the Junior are $\frac{3}{8}$ in. thick, $4\frac{1}{2}$ in. wide and $1\frac{3}{4}$ in. deep, and open $3\frac{1}{4}$ in.

L-W Chuck Co., 45 S. St. Clair, Toledo 4, Ohio. **T-4-1971**

Bevel Gear Chuck

The Splinemaster chuck, designed for economical manufacture of bevel gears, is a self-contained unit with cylinder and mounting plate. It incorporates a locating pin which has a free-rotating contact ball which automatically adjusts to a new contact point with each loading and unloading of work. Tests, made



during production of about 50,000 precision bevel gears loaded in the chuck, indicated wear on the ball of only 0.0006 in., and the ball remained a perfect sphere.

If a ball should wear down to a point of no use, it can be replaced with a standard steel ball, minimizing the cost and down time. The rotating ball locator pin can also be used with other chucks. The chuck can be used for either OD or ID operations.

Splinemaster Products Co., 6781 Maxwell, Van Dyke, Mich. **T-4-1972**

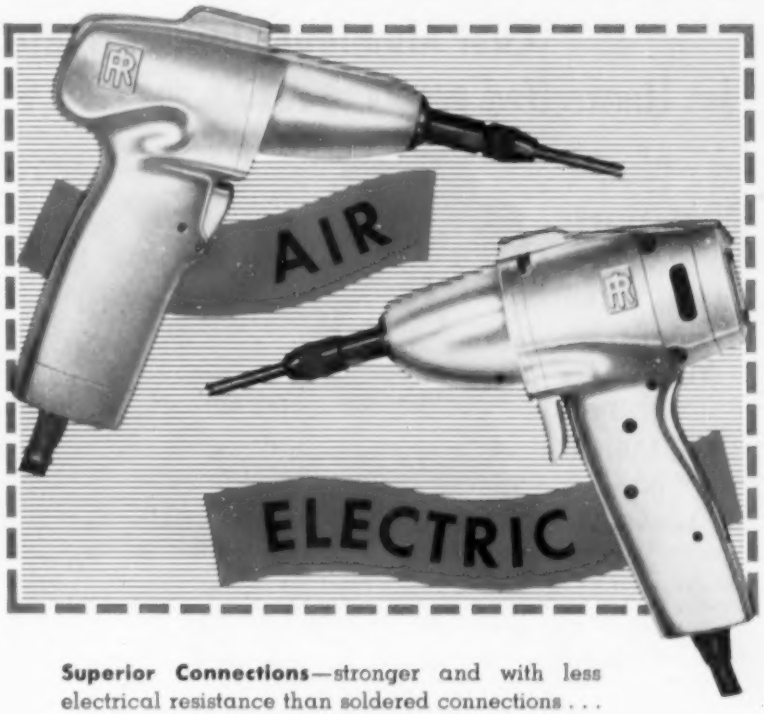
Surface Cleaner

Designed to prepare metal surfaces for repainting, the Roto-Scraper quickly and thoroughly removes paint, mill scale and rust. The tool, which weighs

...make faster, better electrical connections

New Ingersoll-Rand

WIRE WRAPPERS



Superior Connections—stronger and with less electrical resistance than soldered connections . . . yet easy to remove if necessary.

More Compact Assemblies—because wire wrapped connections can be more closely spaced.

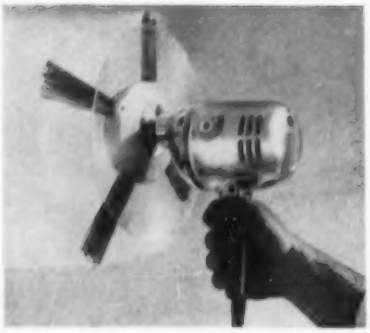
Greater Uniformity—removes the human element . . . a perfect connection every time.

Lower Costs—for labor and inspection. Rejects due to wire and solder shorts are eliminated.

Write today for a demonstration in your plant by an I-R wire wrapping specialist.

Ingersoll-Rand
11 Broadway, New York 4, N.Y. 8-505

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-197



only 2½ lb, is clean, quiet and easy to use. It can be used for all types of metal and masonry surfaces.

Roto-Scraper, Dept. 134, 2960 W. Valley Blvd., Alhambra, Calif. **T-4-1981**

Adjustable Boring Bar

Change from a turning to a threading or facing operation, or from a job requiring triangular inserts to one requiring round or square throw-aways is possible with microadjustable boring bars.

Complete tool change requires only replacement of the standard anvil. The rest of the boring bar, including chip breaker clamp and microadjustment, requires no change.

The interchangeable anvils are fitted

with carbide to support the throw-away inserts, and provide long life and shock resistance for the inserts.

Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich. **T-4-1982**

PIONEER 921-T

Cast Aluminum Tooling Plate for Unexcelled MACHINABILITY

plus
STABILITY
plus
LIGHT WEIGHT
plus
VERSATILITY
plus
AVAILABILITY
plus
LOW COST

PIONEER 921-T Cast Aluminum Tooling Plate is the *universal* tool and jig material, lending itself to fast, precise fabrication at great savings in time and material while maintaining tolerances within ±.0005" in machining operations. It is easily sawed, tapped, milled or welded; is stable to the highest degree; weighs 60-70% less than steel, and is relatively free of porosity and casting defects. Write to receive periodic bulletins on applications and technical case histories.

Pioneer 921-T is available through these suppliers:

ALBUQUERQUE, N.M.: Morris Steel & Supply Co.
ATLANTA, GA.: Southern States Iron Roofing Co.
BOSTON, MASS.: American Steel & Aluminum Corp.
Joseph T. Ryerson & Son, Inc.
BIRMINGHAM, ALA.: Southern States Iron Roofing Co.
CHICAGO, ILL.: Joseph T. Ryerson & Son, Inc.
CLEVELAND, O.: Kaole Steel Corporation
DALLAS, TEX.: Vinson Steel & Aluminum Co.
DEARBORN, MICH.: Pioneer Aluminum Inc.
DENVER, COLO.: ABC Metals Corporation
DETROIT, MICH.: Kaole Steel Corporation
GRAND RAPIDS, MICH.: Kaole Steel Corporation
HARTFORD, CONN.: American Steel & Aluminum Corp.
HAZEL PARK, MICH.: Meier Brass and Aluminum Co.
HILLSIDE, N.J.: Edgcomb Steel & Aluminum Corp.
HOUSTON, TEX.: Vinson Steel & Aluminum Co.
JERSEY CITY, N.J.: Joseph T. Ryerson & Son, Inc.
KANSAS CITY, MO.: Industrial Metals, Inc.
LOS ANGELES, CALIF.: Braico Metals, Inc.
LOUISVILLE, KY.: Southern States Iron Roofing Co.
MEMPHIS, TENN.: Southern States Iron Roofing Co.
MIAMI, FLA.: Southern States Iron Roofing Co.
MILWAUKEE, WIS.: Joseph T. Ryerson & Son, Inc.
NASHVILLE, TENN.: Southern States Iron Roofing Co.
OAKLAND, CALIF.: Earle M. Jorgenson Co.
RALEIGH, N.C.: Southern States Iron Roofing Co.
RICHMOND, VA.: Southern States Iron Roofing Co.
ST. LOUIS, MO.: Industrial Metals, Inc.
SOUTH BEND, IND.: Kaole Steel Corporation
UNION, N.J.: Mapes & Sprowl Steel Co.
WALLINGFORD, CONN.: Joseph T. Ryerson & Son, Inc.
WICHITA, KAN.: Industrial Metals, Inc.

SALES REPRESENTATIVES:
Morris P. Kirk & Son, Inc.
4050 Horton St., Emeryville 8, Calif.
Also: Fresno, Calif.; Phoenix, Ariz.

The Norwest Company
330 Second Ave. West, Seattle 99, Wash.

EASTERN SALES OFFICE:
Pioneer Aluminum Inc.
Richard G. Evans, Mgr.
23439 Michigan Ave., Dearborn, Mich.

SOUTHWEST REGIONAL SALES MANAGER:
Howard L. Hutchinson, P.O. Box 702, Dallas, Tex.

PIONEER ALUMINUM INC.
Subsidiary of MORRIS P. KIRK & SON, INC.
5251 West Imperial Highway • ORegon 8-7621 • Los Angeles 45, Calif.

TOOLING PLATE
HEATING PLATENS
VACUUM CHUCKS
EXTRUSIONS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-198

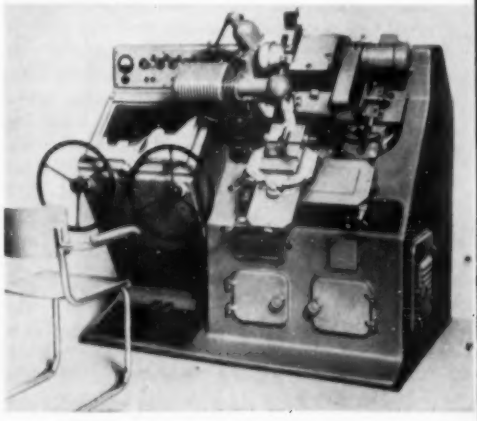
USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Optical Profile Grinding Machine

By using episcopic and diascopic light for projection, the Petewe PFS 4u optical profile grinding unit grinds all types of forms by flat, relief, axial circular and radial circular form grinding. Accuracy is within ± 0.00008 in. at 100x magnification.

The unit produced in West Germany, is available with magnification of 10, 20, 50 and 100x, and handles a maximum workpiece thickness of 3.15 in.

Distributed in the United States by Carl Hirschmann Co., Inc., 30 Park Ave., Manhasset, L. I., N. Y. **T-4-1983**



FIELD notes

Abrasive Machine Tool Co. this year observes the 40th anniversary of its founding. The plant, still located on the original site, now encompasses ten and a half times the first floor space and is operated by almost twenty times as many employees. To mark the event, the original machine surface grinder which spurred the founding of Abrasive Machine Tool has been sent to the Smithsonian Institution where it will be part of the permanent display among the industrial exhibits.

V V V

Second in DoAll's series of traveling exhibits, "The Story of Measurement" has started on the first lap of its tour throughout the United States. The exhibit and lecture describes evolution of measurement standards, techniques and instruments used today as well as 5000 years ago. Currently the exhibit is touring the northeastern states, and during the 1957-58 season will be in the southeast. Tentative plans for 1958-59 are to cover the western states. Information regarding details and bookings may be obtained from the company's Gage Div.

expansions

A $600,000 expansion program for 1957 has been announced by the Putnam Tool Co. Expansion is to include a major plant addition, new manufacturing facilities and equipment.

V V V

With the opening of a new $14-million slabbing and blooming mill at its Roemer Works, Sharon Steel Corp. increased that plant's capacity to 1,200,000 tons a year. The mill, representing the largest capital expenditure program in the company's history, enables Sharon to process stainless and high alloy steels. With increased electric furnace capacity planned for 1957, the firm's total ingot capacity is expected to exceed 2,000,000 tons by end of the year.

V V V

Magnaflux Corp.'s main plant has been enlarged by a new building addition which increases the company's assembly area by a third. The additional space will be devoted to further production operations.

V V V

Expansion plans involving an expenditure of $16-million will permit Quebec Iron & Titanium Corp. to increase its production of titanium dioxide slag by 60 percent. The program calls for three new furnaces and auxiliary equipment at the Sorel, Quebec, processing plant. Greater output will help to meet the increased demand for slag for processing into titanium dioxide pigment.

corporate changes

Lake Erie Engineering Corp. has been acquired by the Bell Aircraft Corp. It will be operated independently as a wholly-owned subsidiary of Bell. No changes in management, personnel or products are expected.

V V V

Parker Appliance Co. has purchased two West Coast firms of The Franklin C. Wolfe Co., Inc. of Culver City, Calif. and the Mathewson Corp. of Los Angeles. The two acquisitions involved a total of 45,000 shares of Parker common stock and $180,000 in cash. The Mathewson Corp. will be moved to a new plant now under construction adjacent to the Wolfe company, and together with the latter will be operated as the Franklin C. Wolfe Co., Div. of Parker Appliance.

V V V

Standard Steel Treating Co. recently purchased Steel Treat, Inc. in Detroit to round out its heat treating facilities. The heat treating plant will be identified as Standard Steel Treating Co. plant No. 2.

V V V

Completion of a 10,000-sq ft, one-story building at 24800 Plymouth Rd., Detroit, has been announced by Omer E. Robbins Co. The structure is an addition to the company's present manufacturing and office facilities.

Acquisition of Standard Transformer Co. has been announced by American Gage & Machine Co.

V V V

Merging of Production Instrument Co. with General Controls Co. has been announced. The transaction involves purchase of all assets of Production Instrument by General Controls.

name change

Daco Instrument Co. is the new name of Daco Machine & Tool Co. Reason for the change is that during recent years, scope of the company's work has been concentrated in the design, prototype-making, tooling, manufacture and assembly of electro-mechanical instrumentation.

V V V

Corporate name of Plumb Tool Co. has been changed to Pendleton Tool Industries, Inc. The parent company plant located in Los Angeles and a division located in Jamestown, New York, will operate under the name of Proto Tool Co., as divisions of Pendleton. Other subsidiaries of the parent company will continue to operate under their own corporate names.

new companies

Formation of Hydroforming Co. of America, Inc. was recently revealed. The new firm, located at 7400 W. Lawrence Ave., Chicago, is concerned with a custom deep drawing process that operates without conventional dies to combine deep drawing precision with freedom of design.

V V V

Geartronics Corp. has been founded to coordinate research and manufacturing facilities of Massachusetts Gear & Tool Co. of Woburn, Mass. and Gear Systems Inc. of West Concord, Mass. Through the new organization, facilities for production of both precision and commercial gears, complete gear systems and gear research and development will be available for industrial and military applications.

V V V

Formation of a research and development division, which will work in cooperation with research laboratories of Aluminum Co. of America, has been announced by Sullivan Powdered Metals, Inc. of Cleveland. The new division will be devoted exclusively to development and application of special blends of aluminum pastes and powders for use as pigments in plastics, paper coatings, printing inks and fabric finishes. Most important phase of the division's

work will be in development of new formulae to combine aluminum with other materials especially for the plastics and printing fields.

research centers

New research facility at The Barden Corp. has been completed. The center will be devoted to an accelerated program of research and development directed toward higher performance levels for mechanisms utilizing precision ball bearings.

Lord Chemical Corp. of York, Pa. recently opened what is possibly the world's largest research and experimental center for barrel finishing of metals and plastics. The plant addition contains an experimental tumbling room, chemical laboratory, office, sample-storage space, and a modern display room.

V V V

Plans for construction of a nuclear research center in Sterling Forest, N. Y. were announced by Union Carbide and Carbon Corp. Research programs will be geared to the study of the effects of radiation on products and processes involving plastics, gases, metals, carbons and chemicals. The facility, which will include a five megawatt pool-type reactor, a radioactive materials laboratory, an ores and engineering laboratory, and a building for allied research operations and administrative functions, is scheduled for completion by late 1958 or early 1959.

warehouse news

A 40,000-sq ft warehouse, sales office and service shop is to be erected in Shreveport by Simonds Saw and Steel Co. The facility, located in Freestate Industrial Park, will serve as a distribution and service center for the surrounding nine-state area applying to the full line of products made by Simonds Saw and Steel Co. and its subsidiaries, Simonds Abrasive Co. and Heller Tool Co.

V V V

A larger mill-branch warehouse has been opened in St. Louis, Mo. by The Carpenter Steel Co. to service and supply users in its south-central sales territory. The facility replaces a former warehouse in the area.

A new branch-mill warehouse also was opened by Carpenter in Toledo, Ohio, to stock and service a broad range of its most popular tool steels and drill rods.

new facilities

A two-story building, providing approximately 20,000 sq ft of floor space is to be constructed for The Timken Roller Bearing Co. across from the company's main offices on Dueber Ave., S.W. in Canton, Ohio. The new structure will house the company's physical, railroad research, electronic, photographic and lubrication laboratories.

The company earlier announced the construction of a $500,000 metallurgical research building located just north of its Steel and Tube Div. office.

V V V

The Lukens Steel Co. is beginning construction of a million-dollar physical testing laboratory. The building and related facilities are scheduled to enter full operation within 12 months after construction began.

V V V

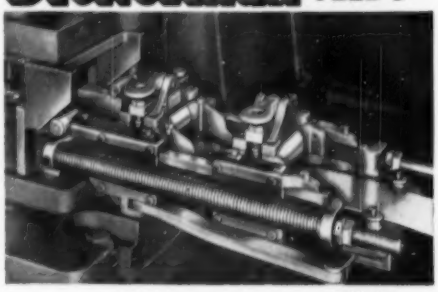
A new foundry for manufacture of aluminum castings for automotive parts is to be established by General Motors near Massena, N. Y. The company also

THE BOSS... gains through automation—overall production economy that means more work per day, per dollar.

8 ways to benefit... save... with

Dickerman FEEDS

PRESS ROOM FOREMAN... benefits by speed—Dickerman feeds operate continuously at any speed the tooling in the press will withstand.



PRESS OPERATOR... welcomes simplified operation—Dickerman feeds prevent human fatigue, human error, work indefinitely without downtime.

QUALITY CONTROL MEN... cheer the constant accuracy and uniformity Dickerman feeds bring to any press feeding job.

ASSEMBLY FOREMAN... gains as components flow in steadily—there's never an afternoon letdown, never a production lag.

THE CUSTOMER... is always ahead because deliveries are always on time, always "as specified".

DIE DESIGNERS praise the Dickerman templates that help them engineer Dickerman feeds onto their presses—send for your copies today!

You'll benefit through increased production . . . greater accuracy . . . bigger profits when you install dependable Dickerman Die Feeds, Hitch Feeds®, and Rol-Di-Feeds on your presses.

Dickerman

H. E. DICKERMAN MFG. CO.

321-315 Albany Street, Springfield, Mass.

Send today for complete details on the money-making Dickerman line

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-200

announced that G.M. and Reynolds Metals Co. have entered into an agreement under which Reynolds will provide aluminum from a reduction plant to be built in the same area. The new facility, which will be operated by the Chevrolet Div., is to be completed and ready for operation in June, 1959.

V V V

Full-scale plant for production of hyper-pure silicon will be constructed near Wilmington, Del., by the DuPont Co. According to schedule, the plant will be ready for operation early in 1958. It is expected to produce about 50,000 lb of semi-conductor grade silicon annually.

V V V

Crane Packing Co. has purchased and put into operation a 30,000-sq ft plant in Vandalia, Ill. The new area is being used to augment Crane's home plant manufacturing facilities in Morton Grove, Ill.

modernization

General Electric Co. has announced it will spend $28-million to expand and modernize its facilities in Schenectady, N. Y. this year. As part of this spending, $600,000 will go toward completion of an Applied Research and Development Laboratory for the Foundry Dept., and $200,000 to create a specialty castings operation. An additional $275,000 will be invested by the Foundry Dept. for annealing furnaces, flasks and other equipment.

V V V

A $1-million loan has been obtained by Leece Neville Co. to use for retooling of company manufacturing facilities, specifically the purchase of new machinery and equipment. Purchases will be made in behalf of all company divisions, but principally for equipment to produce alternator systems and d-c equipment. No part of the fund is to be used for physical expansion of plant facilities.

altered operation

A division to handle engineering and sales for the Pilot automatic copying lathe has been formed by Cone Automatic Machine Co. Headquarters for the new division will be in the company's New York office.

V V V

A new subsidiary, The Tatnall Measuring Systems Co., Phoenixville, Pa., has been introduced by The Budd Co. The organization is set up to offer

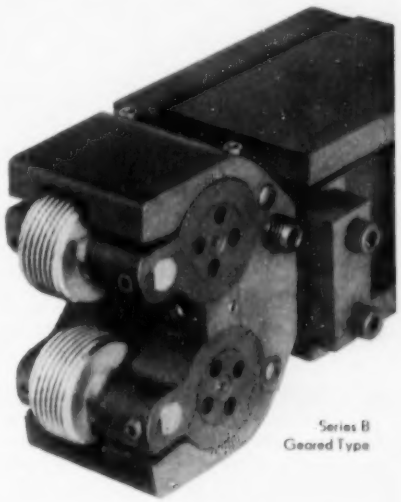
REED

Thread Rolling Attachments

Provide Full Diameter Range To Maximum Capacity

A multi-purpose tool of wide range for rolling machine screw threads, straight and taper pipe threads (including dryseal), annular rings, oil grooves, knurling and other cold forming operations. Eliminates secondary operations by rolling behind shoulders.

- For over 100 different single and multiple screw machines
- Adapters for more than 300 cross-slide applications
- Easy to set up and operate
- Simple precision matching with pre-matched rolls
- Dovetail clamping arrangement simplifies setup by permitting head to be removed from adapter
- Self-compensating roll action



Series B Geared Type

FOUR STANDARD SIZES

Model No.	Complete Diameter Range	*Pipe Threads That May Be Rolled	Approximate Number of Common Screw Threads That May Be Rolled
B 10	0-⅝"	7	80
B 13	⅛"-13/16"	9	90
B 18	¼"-1⅛"	15	105
B 36	⅜"-2¼"	18	185

*Straight and Taper Pipe Threads, including Dryseal (NPTF). Change may be made from Straight to Taper Threading by changing rolls only. No other equipment is necessary.

ATTACHMENTS DESIGNED FOR SPECIAL APPLICATIONS

Attachments and Rolls for Straight Thread and Taper Pipe Thread In Stock—FOR IMMEDIATE DELIVERY

REED SERVICE PERSONNEL AVAILABLE to assist with initial installation. Application and Operating Instruction Book supplied with each attachment. Complete satisfaction assured.

Write for Attachment Bulletin B-1

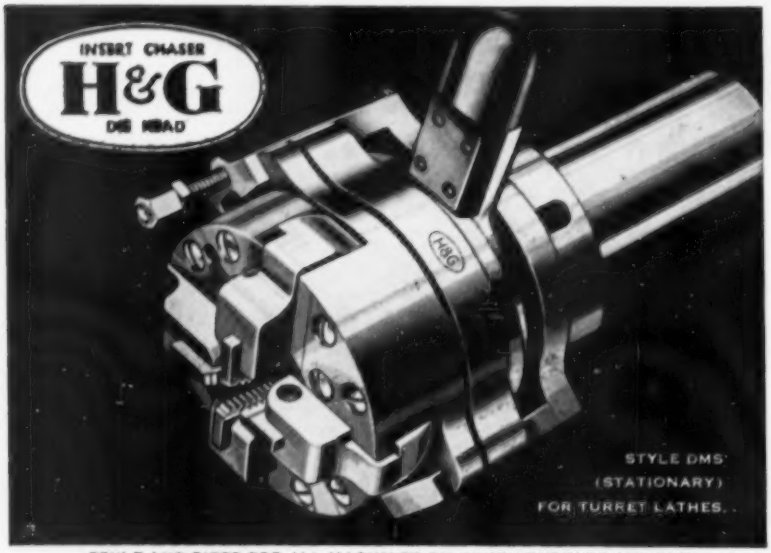
REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-201



STYLE AND SIZES FOR ALL MACHINES ON WHICH THREADS ARE CUT

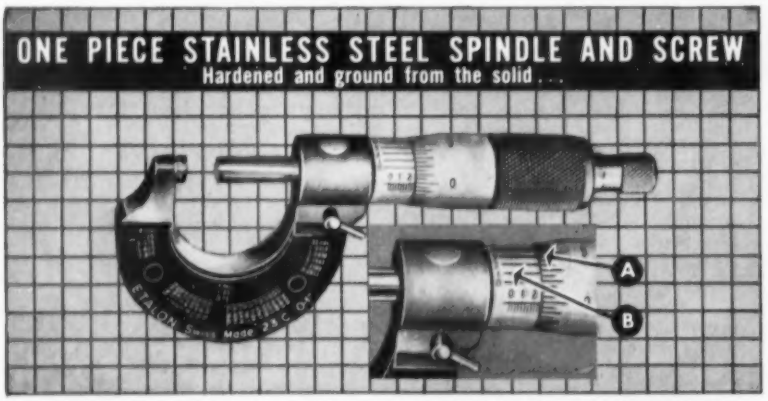
This die head is unique

THERE IS NO OTHER LIKE IT

It cuts threads with insert chasers. These are, in reality, small sections of the business end of large and expensive chasers, but with this important difference: *their cost is so low they can be even thrown away when dull.* For example, for less than $45 you can get a dozen sets of insert chasers, each set ground ready to go. Change now to insert chaser die heads and watch your performance improve. "UNIFIED AND AMERICAN SCREW THREAD DIGEST" sent free on request.

THE EASTERN MACHINE SCREW CORPORATION 27-47 Barclay St., New Haven, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-202-1



ETALON 23C MICROMETER

A—Half-thousandth graduations on thimble allow tenths readings with only 5 Vernier graduations.

B—Deep machine divided graduations on both thimble and barrel assure easy reading.

• Reads to .0001" • Forged frame • Heavy duty tungsten carbide measuring faces, optically lapped • Quick acting positive lock • Feather touch friction stop assures senstive feel • Dull chrome finish on thimble and barrel eliminates glare • Built for accuracy under the most rugged applications • In handsome contour case.

WRITE FOR CATALOG on complete line of precision measure instruments:
VERNIER CALIPERS • MICROMETERS • DIAL INDICATORS

ALINA CORPORATION

122 East Second Street, Mineola, L. I., N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-202-2

packages of technical help, not only test equipment and methods, measuring systems and engineering services, but aid in obtaining a statement of the problem itself, in interpretation of data, and in education and training of personnel.

V V V

Organization of an Engineered Castings Div. to integrate five foundries and coordinate sales of their output was announced by American Brake Shoe Co. The five foundries integrated by the move are located at Medina and Rochester, N. Y.; at Mahwah, N. J.; South San Francisco, Calif.; and Melrose Park, Ill.

V V V

An Instrument Gage Div. has been established by Taft-Peirce Mfg. Co. to further expand company development and production facilities for air and electronic air gaging. The division will offer complete services for engineering, application, sales and manufacture of both standard, special air and electronic gage and instrumentation designs.

line acquisitions

Line of Mercury production grinders, formerly built by Mercury Engineering Corp., has been purchased by Mattison Machine Works. The transaction involved all production rights, including patents, engineering drawings, production tooling and component parts already made. A number of key personnel in engineering and sales for the line are being included in the shift of manufacturing operations to the main Mattison plant.

V V V

Complete line formerly known as the Wye-Stanley cut-off tools has been acquired by Criterion Machine Works which now will be sole manufacturer of the line with distribution rights throughout the United States and Canada. The tools now will be known as Criterion cut-off tools.

awards

The Greer Awards competition is to be continued through 1957. Entries for the maintenance award may be submitted up to November 1 of this year. Information on the competition is available from the Public Relations Dept., Greer Hydraulics, Inc., New York International Airport, Jamaica 30, N. Y.

V V V

The 1957 Design Award Program sponsored annually by Industrial Designers' Institute is open to designers.

Awards are made on the basis of professional evaluation of designers' contributions to the field through the study of mass-produced products submitted on behalf of a specific designer or design team. Submission of designers' work may be made by May 5 on forms available from Walter C. Granville, 38 S. Dearborn St., Chicago 3, Ill.

v v v

Details of the second annual Allmetal Stainless Steel Awards have been announced by its sponsor, Allmetal Screw Products Co., Inc., 821 Steward Ave., Garden City, L. I., N. Y. The 1957 awards, totaling $1500 cash, will be presented for the best case histories describing use of stainless steel fasteners as an ultimate cost-reduction factor in product manufacturing. First prize is $1,000, second prize, $300, and third, $200. Deadline for entries is June 1.

moves

The gage section of the Bryant Gage & Spindle Div. of Bryant Chucking Grinder Co. has been moved to larger quarters.

v v v

Transfer of the manufacturing and sales operations of Baldwin-Lima-Hamilton Corp.'s hydraulic and compacting press department from the Eddystone Div. near Philadelphia to the Hamilton Div. in Hamilton, Ohio, has been completed. Operations have been integrated with those of the mechanical press department which has always been in Hamilton.

v v v

Kuma Tool Co., Div. of Production Tool Corp. has moved to new manufacturing facilities at 3845 S. Lowe Ave., Chicago 9, Ill., which provide considerably expanded manufacturing space to enable incorporation of the latest equipment and manufacturing techniques.

v v v

PIC Design Corp. has moved from Lynbrook, L. I. into its new plant at 477 Atlantic Ave., East Rockaway, N. Y. The new facility provides additional area to permit increasing engineering design and assembly operations of the company's products.

v v v

Executive offices of the Thor Power Tool Co. have been transfered from Aurora, Ill. to the Prudential Bldg. in downtown Chicago. All executive officers in management and sales now headquartered in administrative offices at the Aurora plant are involved in the move.

Makes tough ones *EASY* — and easy ones *SURE!*

THE PROFILOMETER® makes it easy to measure the roughness of nearly *all* machined and finished surfaces, no matter where they are located. It *shows* the roughness, on a meter, in standard *microinch units.* And it gives *consistent, accurate readings* for any surface from polished glass to rough-machined forgings — regardless of the place, the time, the operator, or the equipment used.

As you can see, the Profilometer is a SHOP TOOL, and can be used wherever desired. It is fast and simple to operate (needs no special skill or experience) — is built for hard service — and is reasonably priced. It is *standard equipment* in *thousands* of production and inspection departments, throughout the world.

FREE ILLUSTRATED BULLETIN gives details, and describes *cost-saving applications.* Write for it!

OTHER MICROMETRICAL PRODUCTS include the PROFICORDER® (for obtaining magnified surface profile records); WAVOMETER® (for measuring waviness around surfaces of rotation); ANDEROMETER® (for measuring the over-all quality of assembled ball bearings). Illustrated bulletins on request.

Representatives in principal industrial centers throughout the Free World

Names of above products are registered trade-marks.

MMC

MICROMETRICAL MANUFACTURING COMPANY

349 S. MAIN ST. ANN ARBOR, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-203

who's meeting and where

Apr. 4-5. The Society of the Plastics Industry, Canada, Inc. Annual Canadian Section Conference, Hotel Chateau Laurier, Ottawa, Ontario. Obtain details from society office, 250 Park Ave., New York 17, N. Y.

Apr. 7-11. National Screw Machine Products Association. Annual spring meeting, Shoreham Hotel, Washington, D. C. Write for more facts to association, 2860 E. 130th St., Cleveland, Ohio.

Apr. 7-12. American Chemical Society. Spring Meeting, Miami, Fla. Further facts are available from society office 1155 Sixteenth St., N.W., Washington 6, D.C.

Apr. 8-10. American Society of Mechanical Engineers. Spring meeting. Dinkler Tutwiler Hotel, Birmingham, Ala. For complete information, write society headquarters, 29 W. 39th St., New York 18, N. Y.

FINE CUTTING TOOLS by Eclipse

Since 1913 Eclipse has been consistently and conscientiously serving many companies in widely diversified fields of production. Each of these companies has found that "Engineered by Eclipse" is assurance of genuine quality in end cutting tools.

- High Speed Steel Cutters
- Carbide Tipped Cutters
- Core Drills
- Inserted Blade Cutters
- Multi-Diameters
- Back Spotfacers

and remember . . .

Eclipse now has a complete line of Precision End Mills. Ground from the solid, Eclipse End Mills insure longer tool life, finer finishes and lower production costs.

- Write for Counterbore Cat. No. 51
- Write for End Mill Cat. No. 56

ECLIPSE COUNTERBORE COMPANY
DETROIT 20, MICHIGAN
END MILL DIVISION—NORTH BRANCH, N. J. (ADDRESS BOX 97, RARITAN N. J.)

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-4-204

Apr. 8-10. Metal Treating Institute. Annual spring meeting, Boca Raton Hotel, Boca Raton, Fla. More information may be obtained from institute headquarters, 271 North Ave., New Rochelle, N. Y.

Apr. 8-11. American Management Association. 26th annual national packaging exposition and national packaging conference, International Amphitheatre, Chicago, Ill. Request details from society office, 1515 Broadway, New York 36, N. Y.

Apr. 8-12. American Welding Society, Inc. Annual national meeting and welding show, with AIEE conference. Sheraton, Bellevue Stratford and Benjamin Franklin Hotels and Convention Hall, Philadelphia, Pa. For full particulars, write society headquarters, 33 W. 39th St., New York 18, N. Y.

Apr. 9-10. Conference on Electronics in Industry, sponsored by Armour Research Foundation and Institute of Radio Engineers, Illinois Institute of Technology campus, Chicago. Direct inquiries to Conference Secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

Apr. 9-12. University of Wisconsin. Two engineering institutes: on automatic control for process industries, Apr. 9-10; and on work measurement, Apr. 11-12, to be held on the University campus, Madison, Wis. Write for more facts to Editorial and Communication Services, Extension Div., University of Wisconsin, Madison 6, Wis.

Apr. 13. New York University, College of Engineering. Symposium on engineering aspects of nuclear energy. Get details from Dr. Fred Landis, New York University College of Engineering, University Heights 53, N. Y.

Apr. 14-27. First U. S. World Trade Fair. New York Coliseum, New York, N. Y. Write U. S. World Trade Fair, 331 Madison Ave., New York 17, N. Y., for more details.

Apr. 15-17. Symposium on Information-Handling problems and techniques plus demonstration of systems used for organization, storage and retrieval of recorded information, presented by School of Library Science of Western Research University and its Center for Documentation and Communication Research. Cosponsor is Council on Documentation Research. Contact Western Reserve University, office of Public Information, 2035 Adelbert Rd., Cleveland 6, Ohio, for data.

Apr. 15-17. American Society of Lub-

RICATION ENGINEERS. Annual meeting and exhibit, Sheraton-Cadillac Hotel, Detroit, Mich. Send inquiries to society headquarters, 84 E. Randolph St., Chicago 1, Ill.

Apr. 16-18. AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, The American Nuclear Society, American Society for Testing Materials and Society for Nondestructive Testing. Symposium on use of nuclear materials for nondestructive testing, Morrison Hotel, Chicago, Ill. Get details from AICE office, 25 W. 45th St., New York 36, N. Y.

Apr. 22-26. UNIVERSITY OF WISCONSIN. Intensive course on engineering statistics, University campus, Madison, Wis. Write to Editorial and Communication Services, Extension Div., University of Wisconsin, Madison 6, Wis., for data.

Apr. 24-25. NATIONAL INDUSTRIAL RESEARCH CONFERENCE, sponsored by Armour Research Foundation, Conrad Hilton Hotel, Chicago, Ill. Obtain more facts from conference secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

Apr. 25-26. AMERICAN ZINC INSTITUTE, INC. 39th annual meeting, Drake Hotel, Chicago, Ill. Request other information from institute office, 60 E. 42nd St., New York 17, N. Y.

Apr. 29-May 3. MATERIALS HANDLING EXPOSITION, Convention Hall, Philadelphia, Pa. Data may be had from exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. Concurrently, the American Material Handling Society will hold a conference on new developments in handling.

Apr. 30-May 1. METAL POWDER ASSOCIATION. 13th annual meeting and 1957 metal powder show. Drake Hotel, Chicago, Ill. Contact association office, 130 W. 42nd St., New York 36, N. Y.

May 1-3. ELECTRONIC COMPONENTS SYMPOSIUM, cosponsored by American Institute of Electrical Engineers, Institute of Radio Engineers, Radio-Electronics-Television Manufacturers Assn., West Coast Electronic Manufacturers Assn., Morrison Hotel, Chicago, Ill. More information may be obtained from J. S. Powers, Electronics Components Symposium, 84 E. Randolph St., Chicago 1, Ill.

May 5-7. NATIONAL TOOL & DIE MANUFACTURERS ASSOCIATION. Spring meeting, Mayflower Hotel, Washington, D. C. Direct inquiries to association headquarters, 907 Public Square Bldg., Cleveland, Ohio.

LUFKIN

RADIUS GAGES Now Available for 1-1/16" to 2" RADII

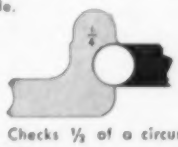
Convenience and Adaptability Have Made Lufkin the First Choice in Radius Gages

1. Determines radius of inside corner and if sides are 90°.

2. Determines radius of outside corner and if sides are 90°.

3. Determines convex radius near projection that prevents use of gage as in views 2 and 5.

4. Checks any concave radius that is ½ or less of circle.



5. Checks ½ of a circumference.

This style radius gage, preferred by toolmakers, diemakers, patternmakers, inspectors, layout men and others, is now available in a complete range of sizes up to 2".

With a design pioneered and developed by Lufkin, each gage is a separate unit with five different gaging applications for use on both concave and convex radii. The gaging surfaces have smooth, accurately machined edges, and the sides of the blade have a polished, natural metal finish.

Available in sets as listed below or by individual gage. Sets are packaged in durable folding cases of heavy red vinyl, fitted with pockets for each edge.

No. 77A	16 gages 1/32 to 17/64 by 64ths
No. 77AX	17 gages 1/64 to 17/64 by 64ths and No. 20 Holder
No. 77B	8 gages 9/32 to ½ by 32nds
No. 77C	24 gages (Sets 77A and 77B Combined)
No. 77CX	25 gages (Sets 77AX and 77B Combined)
No. 77D	16 gages 1/32 to ½ by 32nds
No. 77E	8 gages 9/16 to 1 by 16ths
No. 77F	8 gages 1⅛ to 2 by 8ths
No. 77G	16 gages 1 1/16 to 2 by 16ths

BETTER MEASURE WITH LUFKIN
TAPES • RULES • PRECISION TOOLS

473

THE LUFKIN RULE CO., Saginaw, Michigan

IT PAYS TO USE YOUR INDUSTRIAL DISTRIBUTOR
. . . He can simplify your purchasing

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-205

Get Carbide-Gage Wear at One-Third the Cost

When you require maximum gage life, Ritoloy gages will supply it at one-third the cost of solid carbide gages. Both independent research and production use have proved that Ritoloy gages are equal in wear life to solid carbide or plated gages.

Ritoloy gage surfaces are of an extremely hard, wear-resistant nickel alloy. This alloy goes far deeper than the largest wear allowance, is absolutely welded to the shock-resistant steel core, and possesses a very low coefficient of friction.

Make a test of Ritoloy gages in your plant as soon as possible.

Rite-O Tool makes a complete line of plain and threaded plug and ring gages. Rite-O also excells in special gages, fixtures, and tools. Ask for our new facilities brochure.

Rite-O
TOOL and GAGE CO.
321 West Ten Mile Road • Hazel Park, Mich.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-206-1

NEED SPECIAL TOOLING?

Total working time for this accurate, low-cost, durable drill jig — just 35 minutes.

Make complicated jigs, fixtures and holding devices in MINUTES with DEVCON

THE PLASTIC STEEL®

DEVCON makes a precision form of the original part . . . without shrinkage or distortion. Handles like modeling clay . . . hardens to strong, tough metallic piece. DEVCON can be sawed, tapped or ground with metal-working tools. It has extreme strength, excellent adherence to most materials, will not rust or corrode.

DEVCON — THE PLASTIC STEEL will save time and money . . . repairing machinery . . . filling holes in castings . . . mending leaking tanks or pipes . . . making forming dies . . . every plant can use DEVCON.

FREE BOOKLET describes the 4 types of DEVCON — write for your copy today.

Nationally distributed by leading Industrial Suppliers.

DEVCON CORPORATION
300 Endicott Street, Danvers, Mass.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-206-2

MATERIALS AND PROCESSES IN MANUFACTURING—*by E. Paul DeGarmo. Published by The MacMillan Co., 60 5th Ave., New York 11, N. Y. 765 pages.*

Unfortunately, due to a variety of conditions, beginning engineering students do not have a firsthand acquaintance with materials, machine tools, and manufacturing methods. As engineering curricula have changed during the past twenty years, there has been a justifiably greater emphasis on science, and the elimination of the old "shop" courses.

This book is intended primarily as a college-level text for engineering students, and is designed to provide a basic knowledge relating to materials and processes which are used in manufacturing.

Divided into five parts, the book covers materials, casting and forming processes, machining processes, welding and allied processes, and processes and techniques related to manufacturing.

ANALYSIS FOR PRODUCTION MANAGEMENT—*by Edward H. Bowman and Robert B. Fetter. Published by Richard D. Irwin, Inc., Homewood, Ill. Price $7.80. 520 pages.*

Useful developments in the field of analysis of industrial operations have recently far outstripped the textbooks designed for students of industrial management, administration or engineering. To compensate for this deficiency it was necessary to reorganize the initial production management course at MIT.

This book is oriented toward the analysis of the economic problems of production management. It presents the latest methods of analysis and each is illustrated by a specific manufacturing example to show how theory is related to actual production.

Sections include mathematical pro-

gramming, statistical analysis, economic analysis, introduction to case studies and an appendix that includes a glossary of terms.

THE LIGHT METALS HANDBOOK—*by George A. Pagonis. Published by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. Price $9.50. 432 pages.*

The metalworking industries utilize billions of pounds of aluminum and magnesium cast parts and wrought products. In addition, the search continues for alloys of better structural stability at elevated temperatures and under abnormal stresses. There is, nevertheless, a paucity of data readily available to the men working in the fields of research and industry.

Written to serve engineers, the book simplifies the task of gathering facts and information on aluminum and magnesium-base alloys. Correct material selection can be made by comparison of alloying stabilities and chemical reaction characteristics and by following through procurement stages to actual testing.

This book is published in two volumes. Volume I covers the text and Volume II consists of the tables to be used simultaneously with the text.

A MANUAL OF ENGINEERING GEOMETRY AND GRAPHICS—*by Hollis W. Shupe and Paul E. Machovina. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $5.25. 347 pages.*

Drawings employed in modern engineering, science and technology may be classified into two general categories: representational and graphic solutions. Representational drawings serve primarily as the medium for transmitting information, while graphic solutions are drawings made to obtain solutions to problems and often benefit only the maker. With the importance of the problem-solving side of graphics becoming increasingly apparent, drawing courses in many places are being broadened to include more of "analytic" graphics.

Material includes: fundamentals or orthographic projections and their use in the solution of the geometric problems of line and surface relationships, and vectors; functional scales and their applications in conversion and sliding scales, alignment charts, curve fitting and graphic calculus.

Wherever applicable, drawings showing problem solution are separated into stages to illustrate the step-by-step procedure and to avoid complexity.

HOW MUCH DO YOU REALLY PAY FOR MILLING CUTTERS?

Hidden costs make inserted blade cutters more expensive than you think!

HERE'S PROOF!

One piece Carbide Tipped cutters have many advantages over inserted blade cutters-better finishes . . . more rigidity . . . closer tolerance milling . . . and one piece safety.

Now here is *proof* that solid cutters also save money hour after hour . . . day after day. Don't be fooled by the "do-it-yourself" replacement blade cutters-they're more expensive than you think.

NELCO Cutter Number	TOTAL COST NELCO Solid Tipped Cutter	Replacement Blade Cutter	COST Equivalent Replacement Blade Cutter	COST of set of Replacement Blades*	REMARKS
61045	31.00	A	75.00	18.00*	Cost of Complete do-it-yourself cutter and two sets replacement blades $111.00 + replacement and grinding. Cost 3 NELCO Cutters $93.00.
14112F	140.00	B	336.00	84.00*	Cost of Complete do-it-yourself cutter and two sets of replacement blades $504.00 + replacement and grinding. Cost 3 NELCO Cutters $420.00.
12206-1	50.50	C	116.00	40.48*	Cost of Complete do-it-yourself cutter and one set of replacement blades $156.80 + replacement and grinding. Cost of 2 NELCO Cutters $101.00.
10306-½	37.00	D	129.00	33.12*	Cost of Complete do-it-yourself cutter and three sets of replacement blades $228.36 + replacement and grinding. Cost of 4 NELCO Cutters $148.00.
10108F	86.00	E	292.00	102.58*	Cost of Complete do-it-yourself cutter and four sets of replacement blades $702.32 + replacement and grinding. Cost of 5 NELCO Cutters $430.00.

*Figures above do not include removing old blades, inserting new blades and grinding.

FIRST COST IS LAST COST with a NELCO one piece Carbide Tipped Cutter: No expensive downtime to remove, replace and regrind inserted blades. Every NELCO cutter is ready to use-without delay . . . without added "hidden costs!" A spare NELCO cutter costs far less in every way!

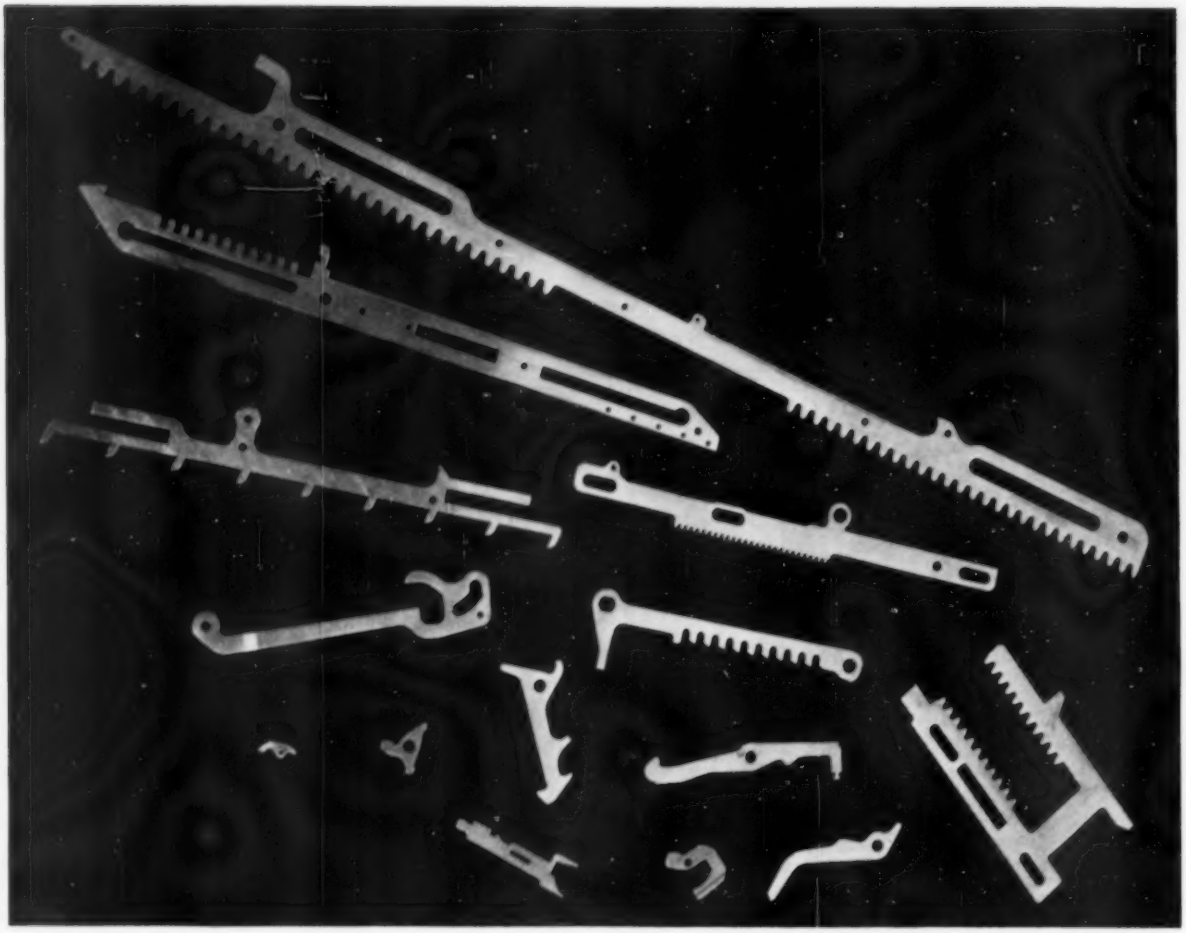
Send today for the New Nelco Catalog showing over 700 carbide tipped cutting tools.

NELCO TOOLS

For that EXTRA Edge in Production!

Nelco Tool Co., Inc. • Manchester, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-207



Business-machine parts stamped with dies made by Eglinton Carbide Products, Inc., Lincoln Park, Mich.

Stamp pre-tempered steel .020 to .040 in. thick . . .

DIES MADE WITH CARBOLOY® CEMENTED CARBIDE SAVE BURROUGHS CORPORATION $300,000 A YEAR!

Dies equipped with Carboloy® cemented carbide now enable Burroughs Corp. to stamp business-machine parts from pre-tempered steel 2-4 times thicker than previously possible.

Parts made from pre-tempered (instead of annealed) stock come out of the dies finished . . . and made to required hardness. This permits Burroughs to eliminate many secondary operations. On one of the parts shown above, for example, heat treating, shaving, straightening, and five other operations are eliminated. Yearly saving on this part alone amounts to over $300,000 . . . and more than 10,000 hours of production time.

These savings far more than pay for carbide dies. In addition, carbides bring new savings in downtime and grinding costs because of their phenomenally long service life. A carbide die has stamped 1,000,000 pre-tempered steel parts per grind . . . while steel dies producing the same part from *annealed* stock had to be re-ground after only 10,000 parts.

Our engineers will work with you or your die maker on the application of Carboloy Cemented Carbides to your dies. For more information, write: *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Street, Detroit 32, Michigan.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

Men at Work

At its recent annual meeting, the Cutting Tool Manufacturers Assn. elected **Leonard H. Skoglund, Jr.** of Scully-Jones and Co. as president. **Robert M. Murdock** of Murdock Tool Co., was elected vice-president of the association, and **George R. Smith** of National Broach & Machine Co. was re-elected treasurer.

Leslie A. Welge was appointed to fill the newly created position of manager of manufacturing services at United States Chemical Milling Corp. Mr. Welge until recently was assistant shops superintendent for industrial engineering and head of plant and processes at Mare Island Naval Shipyard.

New executive assignments in Chrysler Corp.'s engineering division involved **Alan G. Loofbourrow,** who was made executive engineer-product development and planning; **H. R. Steding,** who became executive engineer-product programming; and **Robert Anderson,** who succeeds Mr. Loofbourrow as executive engineer-car chassis, electrical and truck engineering. Mr. Steding formerly was executive engineer-management planning, and Mr. Anderson has been chief engineer at the Plymouth division.

Robert H. Barlow recently joined Clearing Machine Corp., division of U. S. Industries, Inc. as technical consultant in foreign operations. He has been manager of the plant engineering department, metal stampings division of the Ford Motor Co.

Joseph Friedman was elected to the office of president of Chromalloy Corp. Until recently he was executive vice-president of United States Hoffman Machinery Corp.

Recently elected officers of the Society of Plastics Engineers include **Peter Simmons** of Dow Chemical Co., president; **Haiman Nathan** of Atlas Plastics, vice-president; **R. K. Gossett** of Gossett and Hill, secretary; and **Jules W. Lindau, III** of Southern Plastics and the University of South Carolina, treasurer.

The Carborundum Co. has named **S. H. Stupakoff,** a vice-president of the company, as advisor to the group vice-president and to the vice-president of research and development. At the same time, **W. H. Wendel,** formerly vice-president and general manager of the Coated Abrasives Div., was made group vice-president in charge of the Stupakoff Div., Coated Abrasives Div., Curtis Machine Corp. and Globar Div. **R. A. Barr,** formerly sales manager of the Refractories Div. of Carborundum, became general manager of the Stupakoff Div.

Kurt J. Ucko, sales manager of the Machine Tool Div. of Kurt Orban Co., Inc., has been elected a vice-president.

Barnes Drill Co. recently named **Joe Morris** chief engineer. He has 30 years in the design field.

Acme Steel Co. has announced appointments of **Bartlett Richards** as vice-president and presidential assistant, **Harry R. Sanow** as vice-president of Riverdale operations, and **Joseph H. Myers** as general superintendent of the Riverdale plant. Mr. Richards has been vice-president of production, while Mr. Sanow previously was general superintendent, and Mr. Myers was assistant general superintendent.

Linde Air Products Co., div. of Union Carbide and Carbon Corp. has revealed appointment of **H. T. Ross** as vice-president-engineering. Mr. Ross, who has been with the company since 1928, was previously manager of engineering.

Appointment of **J. F. Weiffenbach** as director of research and engineering was made public by Borg-Warner Corp. He has been active in various phases of industrial management for the past 23 years.

Paul E. Busby, who has been assistant director of research, was made director of research for Heppenstall Co. to succeed **R. B. Corbett** who was transferred to the Midvale-Heppenstall Co.

Board of directors of Motorola Inc. recently elected **Paul V. Galvin** chairman of the board and **Robert W. Galvin,** former executive vice-president, to succeed him as president of the company.

Appointment of **Glen R. Fitzgerald** as chief automotive engineer has been announced by AC Spark Plug Div. of General Motors. Mr. Fitzgerald, who has been director of process development section of GM manufacturing staff since 1953, is a member of ASTE's Detroit chapter.

Morris L. Hutchens was elected vice-president in charge of engineering for Kearney & Trecker Corp. Previously he served as the company's chief engineer of special machinery.

J. F. Forster is now executive vice-president of Vickers Inc. and will have direct charge of all operations. He formerly was vice president and general manager of the company.

James R. Keough was elected vice-president for manufacturing at Fenwal, Inc. responsible for manufacturing and purchasing operations for the Ashland and Framingham, Mass. plants.

Kearney & Trecker Corp. revealed appointment of **Herbert Whitney** as chief metallurgist, and **Charles Parske** as chief engineer of the general engineering department. Prior to joining Kearney & Trecker recently, Mr. Whitney was chief metallurgist at Viking Pump Co. Mr. Parske, a veteran of 25 years with the firm, has been associated with its design and development engineering.

Lawrence W. Kelbley is now director of manufacturing for Datamatic Corp. He previously was with Calidyne Co. as plant manager.

Earlier, the company announced election of **John E. Johnson,** formerly director of sales, to the office of vice-president in charge of sales.

J. King Hoyt, Jr. (left) is executive vice-president and treasurer of A. Milne & Co., Inc. which recently celebrated the 70th anniversary of its founding.

William O. Gallery (right) rear admiral, USN (Ret.) has been named vice-president, administration of Verson Allsteel Press Co.

J. Herbert Myers has joined the executive staff of The Cincinnati Shaper Co. after 38 years experience in the machine tool industry. At Cincinnati Shaper, he will hold the title of director of overseas operation.

S. D. Den Uyl, president of Bohn Aluminum & Brass Corp., was elected president of The Aluminum Association at its recent annual meeting. Three vice-presidents elected at the same time are **Russel B. Caples** of Anaconda Aluminum Co.; **W. E. Dunlap** of Aluminum Extrusions, Inc., and **Frank R. Nichols** of Nichols Wire & Aluminum Co.

Two promotions at Denison Engineering Div. of American Brake Shoe Co. involved **Paul W. Norris** and **Denison Neale.** Mr. Norris, who has been vice-president and assistant general manager, was made vice-president and general manager. Mr. Neale, formerly assistant director of sales, became director of sales.

With the announcement of plans for expansion of its activities in the refractories field, Corning Glass Works made public the appointment of **Charles F. DeVoe** as director of ceramic research, and of **Arthur W. Weber** as director of engineering and manufacturing staffs. Dr. DeVoe formerly was director of manufacturing staffs, and Mr. Weber was director of engineering before assuming his additional manufacturing staff duties.

Promotion of **Donald Parks** from engineering supervisor to the post of chief engineer has been announced by Micrometrical Mfg. Co.

Two new vice-presidents elected for Chrysler Corp. are **M. C. Patterson** and **T. F. Morrow.** Mr. Patterson is president of the Dodge Div. and Mr. Morrow is group executive for defense and special products.

The Korfund Co., Inc. has elected **Bela K. Erdoss** president of the company. Dr. Erdoss is also president of Cork Foundation Co., Inc., and Korfund Co. (Canada) Ltd. He succeeds **Siegfried Rosenzweig** who organized Korfund in 1923.

Stanley Adamek was made manager of manufacturing for Pheoll Mfg. Co. He has been works manager for Pheoll. At the same time, **Jack H. Lewis,** western sales manager, was named manager-technical sales.

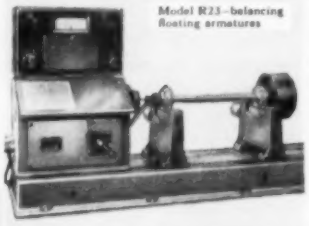
PRODUCTION . . . BALANCING

WITH

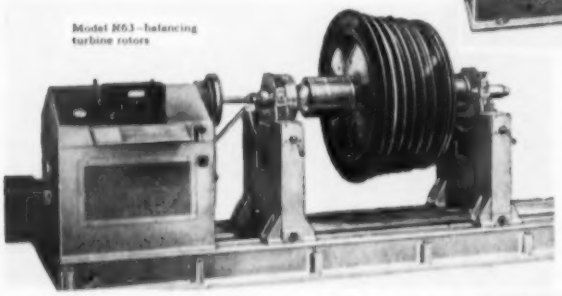
SCHENCK

ELECTRO-DYNAMIC BALANCING MACHINES

Now, in a fraction of a minute and in a single run, you can accurately determine the amount and location of dynamic and static unbalance on rotating parts. The SCHENCK Electro-Dynamic Balancing Machine has a sensitive and accurate electrical measuring system—without electronic tubes or oscillograph—that will indicate unbalances caused by displacements as little as 0.00004" from the center of gravity. Simple and easy to operate, the SCHENCK Balancer, by coordinate measurement, quickly indicates on a Wattmeter the unbalance of the rotating part.



Model R23—balancing floating armatures



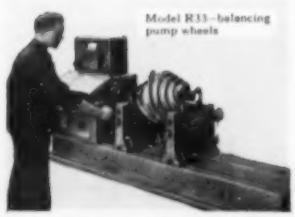
Model R63—balancing turbine rotors

The workpiece is balanced easily by adding or removing weight units at two of the four balancing points located within the coordinates, 90 degrees apart. For many production installations, Schenck Balancers combined with machine tools—check, correct and inspect parts in one set-up.

SCHENCK ELECTRO-DYNAMIC BALANCING MACHINES ARE THE RESULT OF 40 YEARS WORLD-WIDE EXPERIENCE. THEY ARE MADE IN MANY CAPACITIES TO BALANCE ROTATING PARTS WEIGHING UP TO 100 TONS.

Machine Type	#13	#23	#33	#43	#53
Measuring Range (Weight of part in lbs.)	1-22	3-66	1-220	3-660	11-2,200
Machine Type	#63	#73	#83	#93	
Measuring Range (Weight of part in lbs.)	33-6,600	110-22,000	330-66,000	1100-220,000	

Let Cosa Engineers recommend the proper Schenck Balancer for your needs. Or, send for detailed catalog.



Model R33—balancing pump wheels

COSA — *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-210

technical Shorts

ONE MEANS FOR ENDING the shortage of engineers is to induce more young people to enter the field. To this end, the College of Engineering of Ohio State University has just released a new color film, "Engineering for Eddie." The 20-minute sound film is designed to serve as a guide for today's youngsters and their parents in evaluating the educational requirements and practical applications of engineering training.

Film Aims To Attract Students To Engineering

Typical scenes include a modern kitchen, fornace tests of wall construction, a rocket take-off, university laboratories, traffic snarls and assembly lines. The movie defines the engineer's role—both social and scientific—land attempts to answer four questions: What is an engineer? Why is he needed? What does he need to know? How does he become an engineer?

The film is available on a free-loan or purchase basis from the Department of Photography, Motion Picture Div., Ohio State University, Columbus 10, Ohio.

* * *

DEVELOPMENT of cubic boron nitride by scientists at General Electric Research Laboratory has brought to industry a man-made material in the same general range of hardness as diamond, thus many times harder than the next ranking materials in the hardness scale. The new material, named Borazon by its makers, scratches diamond with ease and remains hard at temperatures where diamond burns up. Borazon can withstand temperatures of more than 3500 F while diamond, being basically carbon, literally burns up in air at about 1600 F.

Man Develops Diamond Hard Material

This resistance to oxidation leads the researchers to believe it will lead to superior methods of mounting of stones in industrial tools and also may allow bits and wheels to be operated at higher speeds.

In lapping tests, borazon powder polished away the surface of a large diamond at the same rate as diamond powder.

X-ray diffraction tests, too, show the parallel characteristic of the two materials. Alternate atoms of boron and nitrogen are packed together almost as closely as the carbon atoms in diamond. Density also is about the same. Specific gravity for borazon is 3.45, compared to 3.50 to 3.56 for diamond.

Dr. Robert H. Wentorf, who made the discovery, was also a member of the GE research team whose work resulted in the announcement of man-made diamonds two years ago. Similar techniques were used in the new work—tremendous pressures combined with high temperatures to produce diamond-like crystals of boron nitride.

Ordinary boron nitride is white solid material similar in slipperiness, density and crystal structure to black graphite. Pressures greater than 1,000,000 psi and temperatures exceeding 3000 F are used to produce crystals of boron nitride with structure not hexagontal like graphite, but cubic like diamond.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-211

Trade Literature

for free booklets and catalogs—use convenient request card, page 177

Diamond Dressing Tools

Illustrations and complete descriptions of more conventional types of diamond dressing tools presented in folder which also provides information on company's service for designing and manufacturing diamonds to specifications for special applications. Craine-Schwartz Diamond Tool Co., 8100 Lyndon, Detroit 38, Mich. **L-4-1**

Deep Hole Drills

Engineering file of data sheets on Hi-Standard deep hole drills includes general information and photos of typical installations as well as diagrams and specifications of various types of drills; also gives details on construction, sharpening instructions and machine setups. The High Standard Mfg. Corp., 1817 Dixwell Ave., Hamden 14, Conn. **L-4-2**

ARMSTRONG
GENERAL CATALOG NO. 57

Listing approximately 5,000 quality tools for industry, including:

- ★ Tool Holders (The complete Armstrong System)
- ★ Cutting Tools (Tool Bits, Cut-off Blades, Carbide Cutters and Inserts)
- ★ Lathe and Milling Machine Dogs
- ★ Set-up and Hold-down Tools
- ★ Machine Shop Specialties
- ★ Drop Forged "C" Clamps
- ★ Parallel and Machinists' Clamps
- ★ Drop Forged Eye Bolts and Hoist Hooks
- ★ Drop Forged Machine and Crank Handles
- ★ Drop Forged Wrenches
- ★ Detachable Sockets and Drive Parts
- ★ Bridge Ratchets and Sockets
- ★ Adjustable Wrenches
- ★ Torque Wrenches
- ★ Pipe Tools
- ★ Chain Tongs

No industry reference file is complete without the new Armstrong No. 57 Tool Catalog

Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO.
5257 W. ARMSTRONG AVE. • CHICAGO 30, ILL.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-212

Mold Bases

Describes and illustrates additions to line of standard mold bases; includes specifications, photos, engineering drawings and price lists. Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich. **L-4-3**

Resin Laminations

Technical Bulletin 22 describes in detail the system for making glass-laminated epoxy resin impressions for use in metalworking and model and pattern reproducing. Covers preparation of models, actual lay-up procedure, and suggestions for handling, mixing and weighing and care of tools and brushes. Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City 4, N.J. **L-4-4**

Bearings

Illustrated, 24-page Catalog No. 436, "SKF Multi-Row Cylindrical Roll Neck Bearings," contains engineering and technical data on these bearings designed for heavy duty service in roll neck mountings on hot and cold rolling mills. SKF Industries, Inc., Dept. 616, Front St. and Erie Ave., Philadelphia 32, Pa. **L-4-5**

Optical Jig Borer

Eight-page Catalog No. 82-4 presents information on Leitz 6 x 6 in. optical jig borer with setting in decimals or 0.05 in. Opto-Metric Tools, Inc., 137 Varick St., New York, N.Y. **L-4-6**

Lapping

Important features and advantages of Filmatic centerless lapping machine stressed in extensively illustrated Catalog No. G-683. The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. **L-4-7**

Conversion Factors

Wall chart of conversion factors serves as handy reference table for commonly used measurements; includes such conversions as watts to horsepower, cu ft to liters, microns to meters, etc. Precision Equipment Co., 3714 N. Milwaukee Ave., Chicago 41, Ill. **L-4-8**

Cold Forming

Typical parts which can be produced by the Flotrusion process for cold flowing various metals discussed in 6-page folder; also deals with various advantages of the process. Claude C. Slate Co., 1733 Flower St., Glendale 1, Calif. **L-4-9**

Quenching

"Modern Quenching Techniques" are discussed by O. E. Cullen, chief metallurgist of Surface Combustion Corp., in Vol. 7, No. 3 of *Heat Treat Review*; covers various quenching media and temperature ranges essential to selection of suitable processes; illustrated by photos, tables, charts and diagrams. Surface Combustion Corp., Toledo 1, Ohio. **L-4-10**

Snap Gages

Well illustrated, 8-page brochure presents information on Dializers and Paralloc lever, direct and spherically faced dial snap gages. Standard Gage Co., Inc., Poughkeepsie, N.Y. **L-4-11**

Lathes

Three well-illustrated brochures offer information on features and advantages of various models of Dial-Master lathes; extensively illustrated. The Sidney Machine Tool Co., Sidney, Ohio. **L-4-12**

Cylinders

Two brochures on describing and illustrating cylinders and mounts with detailed outlines of their construction features, capacity charts and other data, include 28-page Bulletin No. 101A on 150 psi air and up to 1500 psi hydraulic cylinders, and 8-page Bulletin No. 105 covering hydraulic cylinders up to 2000 psi. Ortman-Miller Machine Co., Inc., 13 143rd St., Hammond, Ind. **L-4-13**

Magnesium and Titanium

Design data on magnesium and titanium data offered in 44-page booklet; covers physical and mechanical properties, mechanical properties at elevated temperatures, metal weights, forming characteristics, specification tables, corrosion behavior, surface treatments, and other pertinent information. Brooks & Perkins, Inc., 1950 W. Fort St., Detroit 16, Mich. **L-4-14**

Grinding

Extensively illustrated 4-page folder emphasizes main features and advantages of Visual Grind projection grinding machine. The Cleveland Grinding Machine Co., 1685 Eddy Rd., Cleveland 12, Ohio. **L-4-15**

Jarvis Adjustable Pitch
LEAD SCREW TAPPER

NEW!

. . . a cost-cutting OPPORTUNITY you can't afford to miss! One tapper . . . one lead screw . . . convertible in SECONDS to tap *different* pitches!

ANOTHER Jarvis *FIRST!*

send this coupon TODAY!

Jarvis Corporation
Middletown, Connecticut

Yes! I am interested in this new, Jarvis First—the Adjustable Pitch Lead Screw Tapper.

- ☐ Send details and prices
- ☐ Have a Jarvis representative call
- ☐ We would like a demonstration in our plant

NAME..... TITLE.....
COMPANY.....
ADDRESS.....
.....

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-213

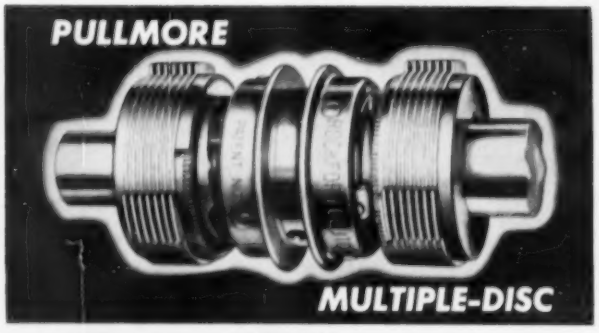
Reinforced Plastics

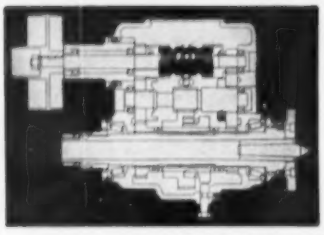
Technical paper, "Use of Adhesives With Reinforced Plastics," reprinted as 8-page booklet, contains data on effect of temperature on tensile shear strengths, physical properties, and bond properties of printed circuit laminates made with various adhesives; illustrated by tables, charts and diagrams; includes bibliography. Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J. **L-4-16**

Welded Steel Tubing

Manual, P.O. 856, describes welded steel tubing formed from Zincgrip, Aluminized, hot rolled and cold rolled steel; also includes pressure tested tubing and fabricated parts; incorporates sections on structural advantages, how the tubing is supplied, mechanical properties and fabrication; contains tables, drawings and photos of applications. Product Information Service, Armco Steel Corp., Middletown, Ohio. **L-4-17**

ROCKFORD





CLUTCHES (Single or Double) PROVIDE HIGH-RATIO LEVER DESIGN

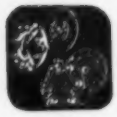
COMPACT DESIGN
HIGH TORQUE
HIGH RATIO LEVERS
POSITIVE NEUTRAL
PRECISION BUILT
LONG WEAR LIFE
EASY ADJUSTMENT

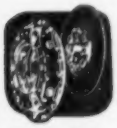
*High-ratio operating levers give PULLMORE clutches powerful engagement with slight axial pressure and short movement of the shifter spool; consequently operation is quick and easy. Declutching is equally fast and positive. The shifter spool has an extra deep slot which is hardened and ground. This prolongs the life of the clutch, reduces wear on the shifter fork and holds run-out to a minimum.

Send for This Handy Bulletin

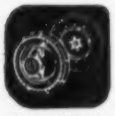
Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD Clutch Division BORG-WARNER
1329 Eighteenth Ave., Rockford, Ill., U.S.A.
Export Sales: Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.


Small Spring Loaded


Heavy Duty Spring Loaded

Oil or Dry Multiple Disc


Heavy Duty Over Center

Power Take-Offs

Speed Reducers

CLUTCHES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-214

Power Brushes

Matic brush to maintain precise brushing action under continuous use, and the Tufmatic brush for stronger brushing action are described in illustrated folder; includes specifications. The Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio. **L-4-18**

Die Sharpening

Extensively illustrated 8-page Bulletin No. 356 (supplement to 48-page "Precisioneering and Productioneering Oberg Carbide Dies") offered as guide to faster, better and easier carbide die sharpening. Oberg Mfg. Co., Inc., P.O. Drawer 231, Silverville Rd., Tarentum, Pa. **L-4-19**

Metalworking Equipment

General Catalog No. M-1961 gives comprehensive coverage of line of milling, broaching, grinding and metal forming machines, grinding wheels, cutting fluids and other equipment; outlines construction features, points out special advantages, includes specifications and photographs. The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. **L-4-20**

Uses for Microfilm

Case histories, special articles and photos on techniques for utilizing microfilm in handling engineering drawings, personnel records, reports, etc. discussed in 35-page brochure, "New Horizons with Microfilm"; also contains product and application information on new developments. Filmsort Div., Dexter Folder Co., Pearl River, N. Y. **L-4-21**

Used Tools

Informative booklet, "How To Buy a Used Machine Tool," offered as primer for the used machinery buyer, written in question and answer form, covers such points as what test equipment to use; things to look for when inspecting used tools; pros and cons of buying "as it," etc. S & S Machinery Co., 140-53rd St., Brooklyn 32, N. Y. **L-4-22**

Aircraft Switches

Complete line of phenolic encased aircraft switches as well as small metal-covered hermetically sealed switches and high-temperature switches presented in 32-page Catalog 78, "Basic Switches for Airborne Equipment." Includes photos, dimensional drawings, electrical data and operating characteristics. Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill. **L-4-23**

NOBLE & STANTON

Standard

JIG & FIXTURE COMPONENTS

complete line—over 500 parts

"FIXTURES IN A JIFFY"

"T" ANGLE PLATES

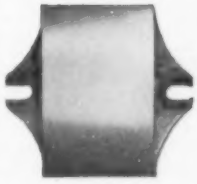
Our "T" Angle Plates have many applications as milling fixtures, comparator stands or drill jigs. The addition of a few special parts make this a complete fixture at little cost. Normalized, precision-machined castings—7 standard sizes.

BOX JIGS

Standard's Box Jigs are made in either square or rectangular styles in 9 sizes. It will pay you to have them on hand in several sizes.

MILL FIXTURE BASES

Mill Fixture Bases are available in a variety of sizes. All are normalized and precision-machined. They are furnished with either standard keyways, or jig-bored holes for "Sure-Lock" Fixture Keys at no extra cost.



"Sure-Lock" Fixture Keys shown in our catalog

WRITE FOR YOUR COPY

FREE CATALOG

illustrating our complete line of top quality jig and fixture parts.

AUTOMATION NOTE: Also Custom-Built Precision Parts for Automation Tooling. Ask us.

STANDARD PARTS CO.

1012 BROADWAY • BEDFORD, OHIO

INDICATE A-4-215-1

abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

High-Speed Machining in Russia

Russian experience in high-speed machining is described in a new book published by Fachbuch Verlag Leipzig. It begins with basic definitions and information on the machining of metals, particularly explaining the influence of cutting angles, depth of cut, feed, cutting speed and other such factors.

The relationship between heat generated by the cutting process and the wear of the tool is discussed in the second chapter, while the third chapter deals with cutting forces and machine tools. Properties of Russian-made carbide tools are also discussed. Hot machining methods are recommended as a means for increasing the cutting speed. The application of negative rake angles is explained. A great part of the book covers regrinding of carbide tools and the economical aspects of high-speed machining. References in the appendix disregard all work done in U.S.A. and in Western Europe.

Cutting Forces in Surface Grinding

A new measuring method has been developed by H. Krug to determine grinding forces in the three directions in space. He reports on his research work in Issue No. 1, 1957 of *Werkstattstechnik und Maschinenbau* and indicates that few cutting force data concerning surface grinding have been available before his own work was finished, although numerous investigations were made on cylindrical grinding.

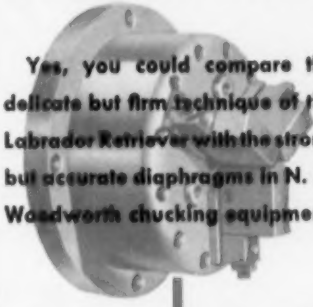
The author used a lever arm system and hydraulic gages to measure the feed force, the tangential force and the infeed force when grinding carbon steel, cast iron and an aluminum-nickel-cobalt alloy.

The main cutting force (tangential force) and the infeed force due to the depth of cut, increase with the depth of cut. It was found, contrary to conventional metal-cutting forces, that the infeed force was greater than the tan-

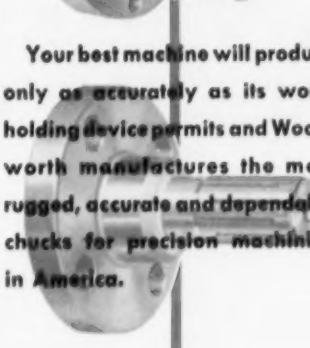
HOLD IT!

WITH WOODWORTH CHUCKING EQUIPMENT

Yes, you could compare the delicate but firm technique of the Labrador Retriever with the strong but accurate diaphragms in N. A. Woodworth chucking equipment.



Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged, accurate and dependable chucks for precision machining in America.



We invite your inspection and consideration of Woodworth chucking equipment.

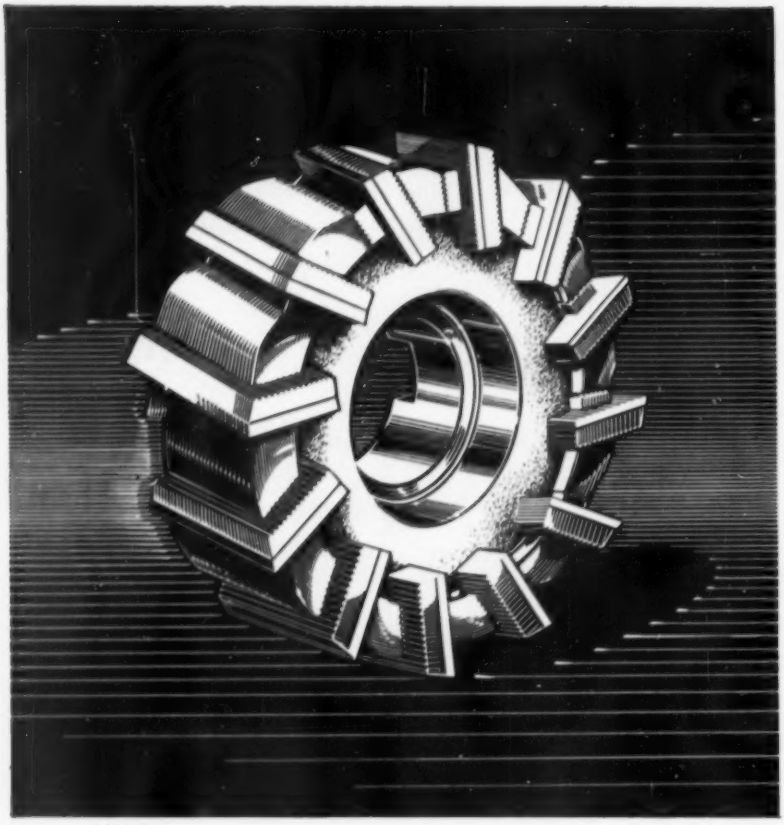
• Standard Diaphragm Chuck • Air-Operated Diaphragm Chuck • Bevel Gear Chuck • Double Diameter Gear Chuck • Finger Chuck • Air-Operated Diaphragm Arbor • Push-Lock Arbor • Twist-Lok Spline Arbor • Tork-Lok Collet Arbor • Zero Spindle Inspection Fixture

"Accuracy you can trust"

WOODWORTH

1300 East Nine Mile Road
Detroit 20, Michigan

INDICATE A-4-215-2



A VERSATILE MILLING CUTTER?

Sure, that's the best description you could apply to a Go & Go inserted high-speed steel blade milling cutter. Here's a tool that's equally at home banging out high production day after day or down in the toolroom carefully carving out a new die. And you can use it on almost any material.

When blades wear, and they do, it's a simple matter to set them out, resharpen and put the cutter back in production. After you've squeezed the last bit of tool life out of the blades, just order new ones from stock and insert them in the cutter body. Blade cost is so low most shops keep several sets on hand all the time.

You can choose just about any style and size of inserted HSS blade milling cutter you'll ever need from the complete line of standards manufactured and stocked by Go & Go. For specifications, ask for Catalog "F". Go & Go also designs and manufactures special milling cutters in quantity. Check your nearest Go & Go representative for details.

Go & Go

GODDARD & GODDARD COMPANY
DETROIT 23, MICHIGAN
Engineering and producing tools that Go & Go since 1917.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-4-216

gential cutting force commonly termed "main" cutting force. Forces up to 400 lb were measured. The feed force is considerably smaller than the other two forces but cannot be disregarded as in the case of cylindrical grinding. The cutting forces on cast iron and on the alloy did not differ greatly, but were both larger than those when grinding carbon steel.

The tangential cutting force decreases with increasing circumferential velocity of the grinding wheel. This holds true particularly at high speeds. The author concludes that less horsepower and smaller motors seem to be indicated when grinding at high speeds, such as 6000-7000 fpm, than at low speeds. However, the infeed force does not continue to decrease with increasing speed, but reaches a minimum at about 3600 to 4400 fpm with subsequent increase when the speed is further increased.

Thus, it is not possible to increase the speed indefinitely because the increase in infeed force puts a limit to such stepping-up of the speed. Deformations of machine and work are caused by the infeed forces, making it necessary to build for high rigidity. The feed force increases with the cutting speed. The specific or unit cutting force, i.e., the force per unit of chip cross sectional area, is a variable quantity as in other metal-cutting operations, depending on size, material and speed of the workpiece.

Milling Research

The size of the built-up edge on HSS milling cutters was measured by H. Phillip for various cutting speeds and feed rates. He describes this phenomenon and other results of milling research in Issue No. 1, 1957 of *Werkstatt und Betrieb*.

At low cutting speeds of about 50 fpm and a feed rate of 0.6 ipm, the built-up edge extended 0.03 in. along the tool face in the direction of the flow of the chip but dropped to about half that dimension when the feed rate was reduced to 0.14 ipm. Keeping the feed rate at 0.6 ipm and increasing the cutting speed from 50 to 125 fpm reduced the built-up edge to 0.004 in. from 0.030 in.

The author used two induction rings attached to the arbor for measuring the torque produced by the milling operations, feeding the electrical output into an oscillograph. He relates his findings for the unit cutting force to the "half-way-chip thickness," a concept frequently used in Europe. This is not identical with the "average chip thickness" often used in American milling research.

The unit cutting force drops with increasing half-way-chip thickness, which is defined as the chip thickness

existing at the instant when the tooth of the milling cutter is at the half-way point of its path in the metal. The half-way-chip thickness depends on the feed per tooth, the depth of cut and the diameter of the milling cutter. The author concludes that low unit cutting forces are conducive to good tool life, at least where the tool materials of his test are used.

Erratic behavior of the cutting force in the up-milling investigations are interpreted by the author as resulting from the compression of the work material before the tooth can penetrate enough to produce a chip. This conclusion is not in agreement with American research, where it was found that the tooth, rather than gliding for a short instant before cutting, follows a downward path into the metal.

The author also included changes in the rake angle of the cutters in his research. In addition he investigated the surface finish produced.

Spar Milling Machine

A special milling machine made in Switzerland for milling ribs for aircraft wings is described in the same issue of *Werkstatt und Betrieb*. The machine can be used for both aluminum and steel.

Werkstatts-Technik—50th Anniversary

The current issue of the German magazine *Werkstatts-Technik* contains several articles comprising a survey of the past 50 years, during which *Werkstatts-Technik* has served the scientific and practical needs of tool and production engineers. Originally established by Prof. George Schlesinger in 1907, it is considered the outstanding European magazine in this field.

At the turn of the century when F. W. Taylor's work on scientific management and metal-cutting investigations became familiar to European industry, the first chair in this field of engineering was established at the Engineering College of the University of Berlin, and G. Schlesinger was appointed to fill it. The mutual give and take between American and European tool engineering knowledge was thus initiated. The name of the magazine, published by Springer Verlag, was later changed to *Werkstatts-technik und Maschinenbau*. It is now edited by Prof. Kienzle.

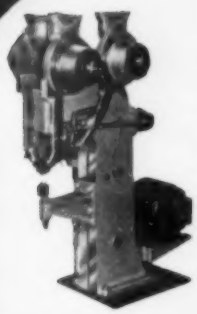
Latest in production, laboratory and research equipment will be housed in an ultramodern facility in Sao Paulo, Brazil which shortly will be manufacturing welding electrodes, gas rods, brazing alloys and fluxes for Eutectic Welding Alloys Corp. to meet increasing industrial demands in South America.

AT Chicago Rivet ALL 3
will reduce your Fastening Costs

rivets

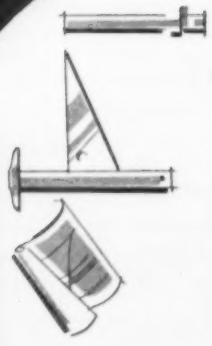
Semi-Tubular, Split and Shoulder

You avoid machine down-time because every semi-tubular, full tubular, split, shoulder or special rivet is precision made and hand inspected to assure free, non-clogging movement in automatic setters.



rivet setters

Your fastening costs are less because Chicago Rivet makes machines that set from one to seven rivets at a time. Riveting is automatic and may involve the use of special indexing fixtures, adjustable riveting centers, and top or bottom rivet feeding and other mechanisms, controlled by solenoids or air cylinders or both.



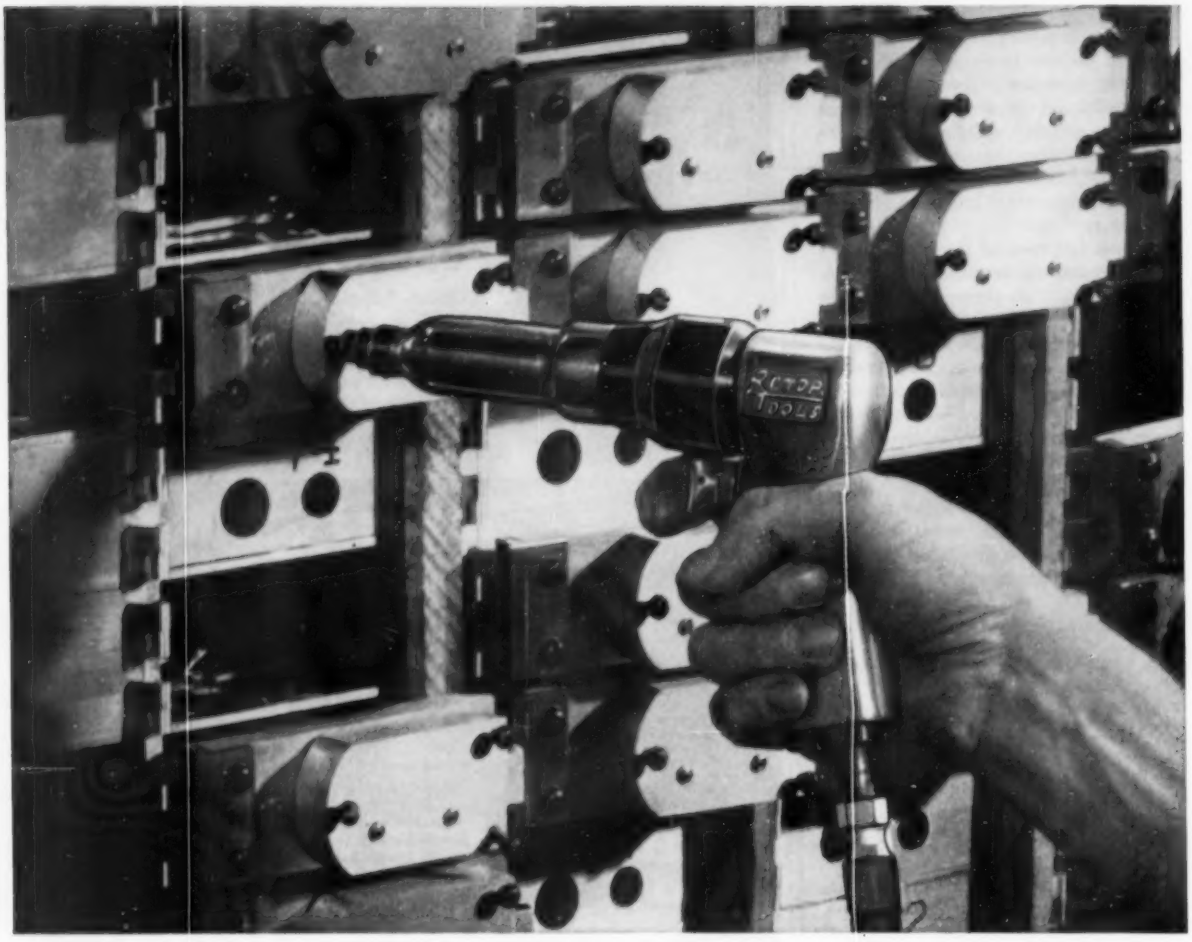
engineering

The recommendations of Chicago Rivet Engineers are most valuable. Their knowledge of rivet fastening techniques, gained from solving thousands of manufacturers' fastening problems can help make your product more competitive. Calling Chicago Rivet is a habit-formed procedure with many companies. You incur no obligation when you use the service of Chicago Rivet Engineers. Send a blue print or sample assembly with your inquiry.

Chicago Rivet & MACHINE CO.
9619 WEST JACKSON BOULEVARD
BELLWOOD (CHICAGO SUBURB) ILLINOIS
BRANCH FACTORY: TYRONE, PA.

New Rivet Catalog contains engineering data, list of popular semi-tubular, full tubular, split and shoulder rivets and popular automatic rivet setters. Write for copy.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-217



Cuts screw-driving time 66%

APPLICATION: Rotor S-02 Air Screw Drivers on vault assembly job *paid for themselves in 8.6 weeks.* **RESULT:** Time per unit with former hand screw drivers was 13 seconds. With the 2000 rpm S-02 PRC, it is 4.4 seconds.

Rotor S-02 screw drivers and nut setters are available with three types of drives, with reversible or non-reversible motor, lever or pistol throttle, and with long or short angle head (with six different spindles). At least three speeds for each model. All models are quieter. Ask for a demonstration on your job. Bulletin 46 free on request. The ROTOR TOOL Company, Cleveland 32, Ohio.

Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR TOOLS
CLEVELAND, OHIO

techniques and materials for low cost tooling

Tech Digests

By F. S. Altman

Production Engineering Activity
Fisher Body Div.
General Motors Corp.
Detroit, Mich.

COST IS OF PRIME IMPORTANCE in the manufacture of any product. In today's highly competitive market, the manufacturer who can reduce costs while maintaining quality and style appeal in his product is the one who will receive the greatest return for his efforts. This fact has become increasingly evident with the return of a buyers market in almost every line of consumer goods.

Many groups make up the task force which attacks problems of automobile body manufacture. These include management, product engineering, tool engineering, construction and production groups, *Fig.* 1.

Rapid expansion of industry has created the need for a specialized and concentrated study of each phase of product and tool processing. The growth of tool engineering is the result of this more analytical approach for attacking production problems. In many organizations the tool engineer is responsible for planning and providing all of the tools, machines and processes for manufacturing the product. In carrying out these responsibilities, it is necessary for him to coordinate his efforts with all other groups in the manufacturing organization.

To meet the demands of his work, the tool engineer must have an active, inquisitive mind and a broad knowledge of manufacturing processes, tools and equipment. He must have an inner drive that keeps him in a state of constructive discontent, which in turn stimulates new methods, new materials and new tools. Tool engineers working for different organizations are in as much competition with one another as their finished products. This competition has been responsible for the development of many of the present day tooling techniques and materials.

Forward Planning

While many industrial organizations have not planned tooling requirements much in advance of actual need in the past, today advanced planning plays an important part in tool cost reduction. Forward planning is a systematic procedure of forecasting tooling needs based on analyses of past tooling programs and projected plans for the new model. Savings are realized because forward planning permits advance ordering of raw materials, tooling standards and commercial items so they can be delivered as required.

Communications is another phase of manufacturing sometimes overlooked in the search for worthwhile savings. In a large corporation the flow of information, data and directives takes on huge proportions. Each division, plant, activity or department must coordinate its activities toward the same goal. Communications must be organized to feed forward and back, to provide full information for decisions as well as to transmit decisions rapidly and clearly. Misunderstanding regarding production schedules, incorporation of engineering changes, cancellations and quantities of tools can be costly.

Tooling Methods

Production line manufacture has created problems of interchangeability of parts with economy. This has resulted in a family of models, gages, templates and similar aids which are known as coordination equipment. They are used for checking, spotting, gaging and otherwise assisting in construction, maintenance or inspection of manufacturing tools and equipment. Coordination equipment facilitates economical

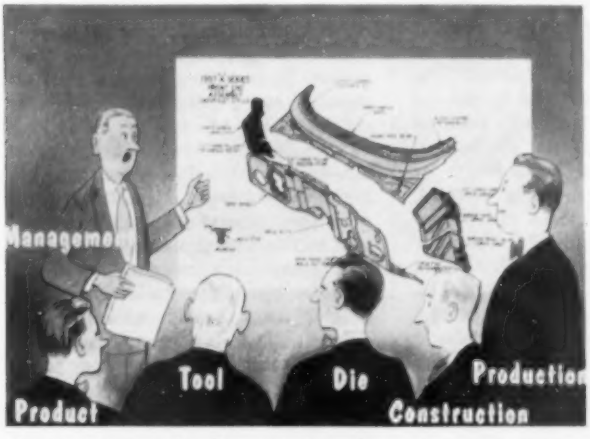


Fig. 1. To organize the manufacturing program management holds meetings with engineering groups, tooling and production organizations.

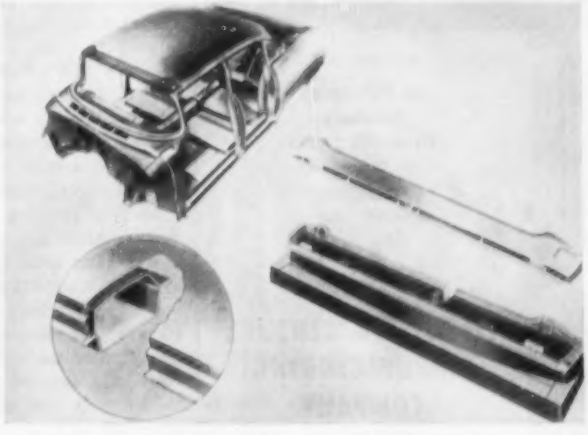


Fig. 2. Die tryout results in sample stampings that are mated to check fit and accuracy of reproduction. Windshield upper frame is shown.

What other tool companies consider "SPECIALS"
(IN DECIMAL SIZES)
... WE STOCK AS STANDARD

Thousands of chucking and Stub Reamers by the .001 in Stock ready for the precise job. Why buy or make "SPECIALS" when you can BUY from STOCK — over night.

SUPEREAM

IN EMERGENCY
Telephone
Libertyville 2-4200

TWENTIETH CENTURY MANUFACTURING COMPANY
BOX 429-TE
LIBERTYVILLE, ILL.

INDICATE A-4-220

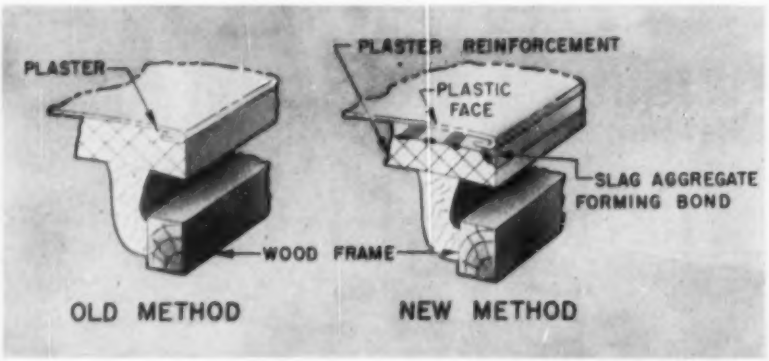


Fig. 3. Typical of tooling trends is use of plastic face in die model take-offs. Result is improved dimensional stability, greater impact strength and wear resistance and improved transfer characteristics.

manufacturing tools and checking equipment. It affords a fast and accurate way of transmitting sheet metal contours, holes, lines, openings and locations. It also establishes a means of controlling quality and the relationship of component parts in tools, so that assemblies will fit properly, *Fig.* 2.

Types of Materials

Selection of materials best suited for construction of tooling aids is an important problem. Generally, materials are selected on the basis of the use to which they will be put and secondly the cost of their manufacture. Initial material cost is usually disregarded unless its selection means expensive pattern in foundry work. Construction costs are much larger than material costs and more dependent upon the type of material selected.

Those requiring little work or auxiliary equipment in pouring, fitting, machining to contours are most desirable from the standpoint of economy for model as well as checking fixture construction. Wood, plaster, plastic, aluminum and steel are the materials most commonly used.

Wood is used primarily because of low material and construction cost. It is easy to work, a good duplicator of contours and quick to construct. Die models, spotting blocks and frames for low cost tooling are generally made of mahogany. Hammer forms are built of laminated poplar and maple with or without metal inserts, while patterns, temporary spotting blocks and plaster model frames are made of white pine.

Wood has some limits. It is affected by climatic conditions which impairs its accuracy over long periods of time. A more recent development is a plastic impregnated mahogany laminate which overcomes some of these objections.

Plaster is also used because of low material and construction costs. It requires little auxiliary equipment in pouring and is a good duplicator of contours. Transfer models, splashes and Keller models made of plaster are used in tool and die construction. They are classified as temporary tooling aids because they retain their accuracy only for short periods of time.

Plastics are relatively high cost materials compared to metals currently in use. These costs are offset by the savings in construction time, labor and weight. Epoxies have excellent adhesive qualities, cure at room temperature and have little or no shrinkage. Models, gages, drill jigs, checking fixtures, trim fixtures and plastic panels are constructed of epoxy resin laminated with fiberglass cloth.

Polyester resin laminates are used for water test shields, paint spray masks, trim fixtures, mold and other applications where accuracy is less important. They are similar in physicals to epoxies except for shrinkage and lower cost.

Low production draw dies, forms, back up blocks for drill fixtures and molds are made of phenolic casting resins.

Plastics have limitations and should not be considered as cure-alls. They are, however, a welcome addition to the list of tooling materials, *Fig.* 3.

Aluminum is used alone or in combination with plastics, steel and other metals. Its combined material and construction cost is reasonable enough for consideration in tooling. Checking fixtures for doors, deck lids, roof rails, etc. are constructed of aluminum castings on steel frames. A special mix, soft aluminum, is used for shaping to contour easily. The cast aluminum frames with epoxy body contour facings are used for checking detail parts. Light weight, strength and workability of different materials are teamed to achieve accuracy, quality and portability. Undesirable qualities of aluminum are its softness which results in damage if improperly handled.

Steel, of course, is one of the most common materials used in construction

of tools, models, gages and checking fixtures. It is especially appropriate for high volume tools because it will withstand severe use and abuse. The tool engineer is continually faced with a problem of investigating and devising new ways and means of utilizing materials to the most economic advantage. He is concerned with the weight of tooling and its effect upon operator fatigue. Thus strength without weight becomes a criterion for tool design.

Prototype body tooling is somewhat different from low volume production tooling, despite similarity in methods and equipment used. Since a limited number of bodies of each style and line are produced, hand tools and manual operations are usual. Ordinarily only a few low cost Kirksite dies are made to draw panels which cannot be made on hammer forms. Laminated wood and Kirksite hammer forms are used to keep costs down. Tool room methods are used to assemble parts in fixtures.

Future Developments

What tool engineers will be using in the future is somewhat dependent upon industry and product engineers. Industry cannot become stagnant. Continued research in new and improved products necessitates similar development in field of tool engineering.

Plastics show further promise of becoming one of the most versatile of all tooling materials. Investment casting is still in the development stage and bears watching for more precision and economy. Aluminum, magnesium and titanium have already found a place in tooling where a combination of light weight and workability are required. Use of commercial stock sizes and extrusions cannot be overlooked. More complex and larger sections are being extruded and tooling plate may save many machining operations.

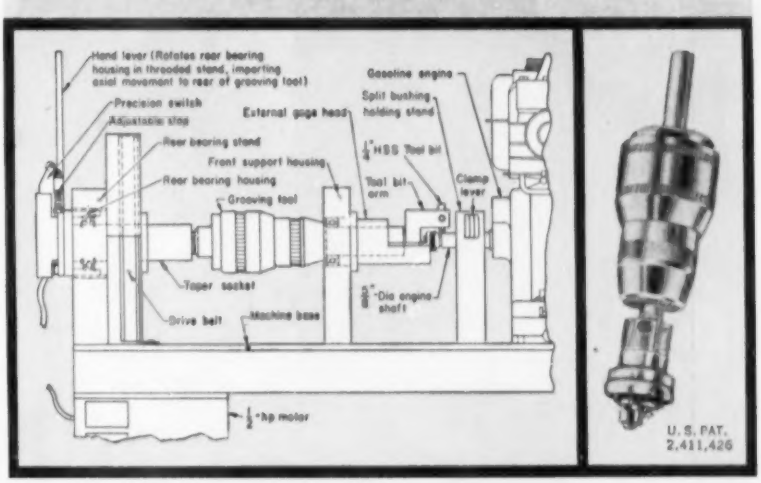
Powder metallurgy, chemical milling, electrical erosion and metal bonding with special adhesives or plastics are other new processes which may soon become important in tool construction.

To build the product, tool engineers must provide the type of equipment which will do the best possible job most economically. Tooling can only be designed within limits that assure a quality product. Quality can be achieved only through coordination of product, process and tool engineering. It is necessary to recognize the need for close collaboration between product and tool engineers.

From a paper presented at the February, 1957 meeting of the Detroit section of Society of Automotive Engineers, Rackham Bldg., Detroit, Mich.

▼ ▼ ▼

Groove cut in shaft of fully assembled engine with WALDES TRUARC GROOVING TOOL



To install a small gear, Clemson Bros. must machine a recess (Tolerance: +.033" —.000") in a shaft of the engine for their power lawn mowers.

Engines arrive fully assembled. Normal procedure was to rotate the shaft. That involved removing a spark plug, mounting each engine firmly and accurately on a lathe, securing a gear or sprocket on the shaft, driving the shaft and moving the stationary cutting tool into position. The engine had to be reassembled after grooving.

All this costly time and labor was eliminated by holding the shaft stationary and *using a tool that rotates*—the Waldes Truarc Grooving Tool, equipped with an external grooving attachment. Because grooving dimensions are pre-set on the tool, there are no rejects caused by inaccurate cutting.

No recessing problem is too tough for this amazingly versatile tool. It's so simple, even unskilled labor can use it accurately...so cost-saving, it often pays for itself on a single small run!

Write now for 20-page manual containing full information on Waldes Truarc Grooving Tool.

WALDES
TRUARC®
GROOVING TOOL
WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-221

new

FOR OPTICAL GAGING

MULTI-USE FIXTURE PROVIDES LOW COST STAGING FOR MANY SMALL PARTS

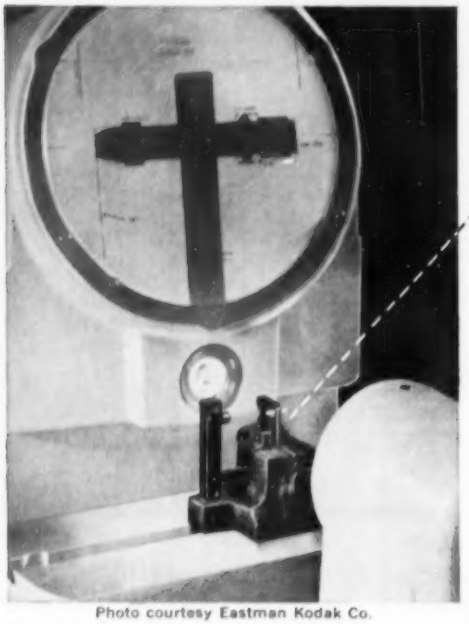
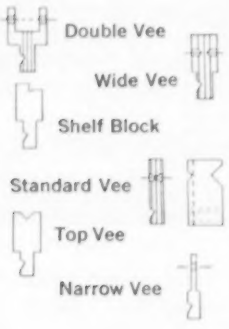


Photo courtesy Eastman Kodak Co.

O. G. P. Multi-Use Fixture fits all types of optical comparators.



O.G.P's NEW Multi-Use Fixture has replaceable part holders designed for holding many types of small parts. Standard holders in varying sizes and shapes are available (see drawings above). Quickly locks into keyway with clamp.

EVERYTHING TO MAKE YOUR OPTICAL COMPARATORS MORE USEFUL

We also supply all types of standard charts, custom charts, layout accessories, fixture bases, and custom fixtures to meet your specialized requirements.

USE THIS COUPON TO GET HELPFUL INFORMATION

OPTICAL GAGING PRODUCTS, INC.
26 Forbes Street, Rochester, New York
I'd like more data on the NEW O. G. P. Multi-Use Fixture.

Name ..... Title .....
Firm .....
Street and Number .....
City ..... State .....

OPTICAL GAGING PRODUCTS, INC.
SPECIALISTS IN PROJECTION GAGING

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-222

The Role of Scientists and Engineers in Society

By L. R. Hafstad
V. P. Research
General Motors Corp.
Detroit, Mich.

Working scientists cling stubbornly to the faith that they somehow are contributing to human comfort and happiness and that however stumbling the progress, this progress is upward. Many predictions are made as to the high standard of living which will be obtainable in a few decades. Shortages of raw materials have been emphasized, but technological ingenuity is such that so far as material prosperity is concerned the possibilities do indeed seem limitless.

Much has been written about the shortage of scientists and engineers. This world-wide problem is most acute where development of technology is most intense. It would seem axiomatic that the brave new world of plenty cannot be attained without an adequate supply of scientists and engineers. It seems somewhat surprising that so much campaigning and propaganda should be necessary to correct a shortage so obvious.

This country is now belatedly beginning to use a potent force—the incentive system—to correct the shortage.

There seems to be a tacit assumption that the purpose of the kind of society desired is one which gives greatest good to the greatest number. Society has seized upon technology as a clearly applicable means to this end. One would then assume that society, more accurately the nontechnical controllers of that society, would as a matter of enlightened self interest pay particular attention to education and training of an adequate supply of what they refer to as "technicans."

Instead it is the technicans, scientists and engineers, who have been calling for an increase in supply of talent even though it would be to their own self interest to restrict this supply of skills and thus improve their bargaining position.

In this society progress is demanded, in fact it seems to be taken for granted as a law of nature, but there are influential people who seem to be doing their best in the education process to escape or circumvent science and technology, which alone can make progress possible. What is serious and more dangerous than the shortage in the long run, is that the mass of population, who in a society dedicated to the greatest

good for the greatest number, must in the end control it, remains in ignorance of the foundations on which that society is based.

In contrast to the studied complacency of educators and humanist, to the scientist progress represents work. He is convinced that further progress cannot be made without struggle. To him there is nothing automatic or guaranteed in the comfortable and continuous progress, which the humanist and progressive educator seem to take for granted.

Since society has chosen for itself a kind of civilization overwhelmingly dependent on advances in science and technology, education for the rest of the citizenry should include a basic understanding and appreciation of technological society, both its strengths and limitations.

In fact those who have done should teach, and accordingly those who have taken an active part in creating the technological society should be best able to interpret it for others. Unfortunately the shortage of technical talent exerts great pressures upon individuals skilled in those fields to concentrate on technical problems. Since scientists and engineers are notoriously inarticulate, a suitable education should include a heavy concentration on the arts of communication.

Difference Between Scientists and Engineers

Even simple and basic things as a relation between research and engineering, technology and standard of living or progress and incentive are not understood.

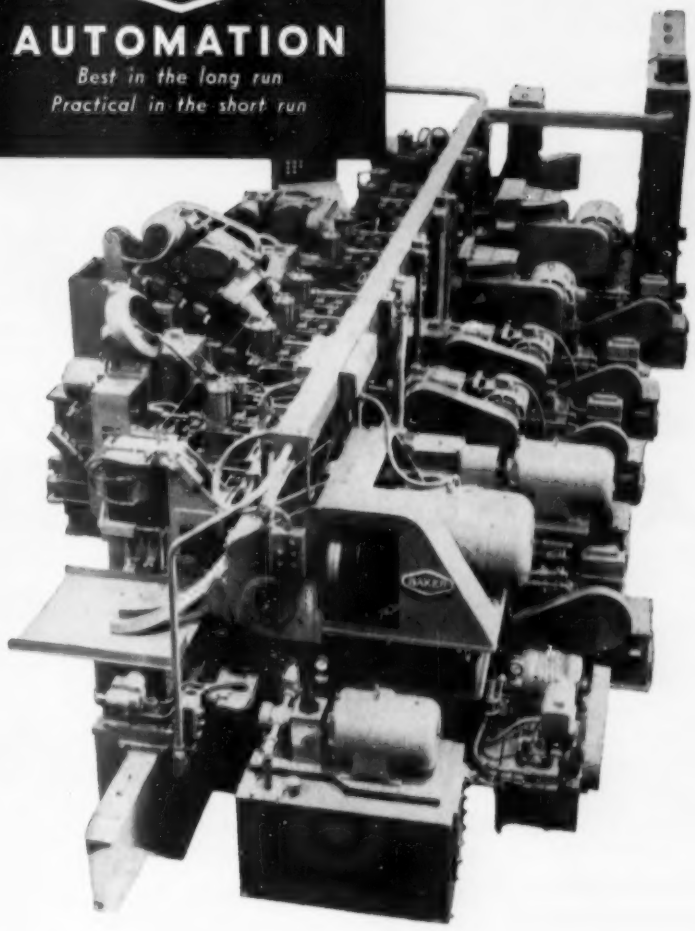
The business of the researcher is to get really new information. A scientist's work is completed when an item of information is established and recorded. The same man who makes a discovery may chose, or be persuaded, to attempt to apply it to a practical problem. In this case he ceases to be a scientist and works essentially as an engineer. He is motivated not internally as a scientist but externally by society. The distinction is made to counter the argument that it is the scientist who has created the complexities of modern industrial civilization. It is society itself, and particularly nontechnical elements, which creates the demands which are the motive force behind technology.

Thus there is a continuing divergence in point of view between the sciences and the humanities. With the sciences, through the mechanisms of technology, being called upon to make an ever in-

BAKER

AUTOMATION

Best in the long run
Practical in the short run



THIS BAKER SPECIAL

ups production to 75 main bearing cap assemblies per hour.

Operations are: drill, ream, mill, tap, assemble dowels, and separate — all automatic.

OLD TIMERS' CORNER

Remember when Baker made nothing but gear-feed drilling machines? Quite a contrast with modern Baker specials — the bulk of Baker output today.

BAKER BROTHERS, INC.
Dept. TE-457, Toledo 10, Ohio

Send me data on automation with
☐ Baker Specials . . ☐ Baker *standard* machines.

NAME AND TITLE

COMPANY

ADDRESS

CITY ZONE STATE

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-223

Syntron Lapping Machine lapping mechanical shaft seal faces to precision flatness in production quantities.

SYNTRON

Vibratory

LAPPING MACHINES

Low cost, High speed lapping and polishing of parts in production quantities.

Syntron Lapping Machines save many man hours, and cut production costs by producting metallographic finishes and precision flat surfaces on component parts in production quantities. Their gentle vibration with variable speed control assures a positive polishing action on parts or samples where metallographic finishes are required.

Investigate how Syntron Lapping machines can cut your production costs.

Easily installed—no expensive grinding equipment necessary. Low cost, dependable operation.

Other SYNTRON Equipment of proven dependable Quality

POWER CONVERSION UNITS

SHAFT SEALS

BATTERY CHARGERS

Write for complete catalog data—FREE

SYNTRON COMPANY
340 Lexington Ave. Homer City, Pa.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-224

creasing contribution to society as specified by the humanists, there is serious cause for concern in the fact that the educational system at the elementary and secondary levels seems to be out of step with the foreseeable needs of such a society. Desire for progress cannot be reconciled with lack of attention to, and an incentive for, students of exceptional ability. Desire for progress is inconsistent with the trend toward effortless education and the substitution of pastimes for disciplines.

Finally, the assumption that a larger and larger population can be supported on and by the work of a smaller and smaller fraction of highly trained creative specialists leads to a social structure like that of an inverted pyramid. Even more acute than the current shortage of scientists and engineers is the shortage of people who both can and will carry responsibility.

From a talk given before the Scientific Research Society of America at the annual meeting of the American Association for Advancement of Science, 1515 Massachusetts Ave., Washington 5, D. C., December, 1956

▼ ▼ ▼

Applications of Shell Molding

By H. G. Sieggreen

Chief Engineer
Central Foundry Div.
General Motors Corp.
Saginaw, Mich.

Shell molding is particularly advantageous for quick and simple production of complicated molds, such as those requiring narrow and accurate passages and cross section. It is practically impossible to produce certain parts in other way without prohibitive costs. This is especially true of ferrous metals.

The process derives its name from the physical nature of the mold, which is a shell or wafer of sand bonded by phenolic resin into which the metal is poured, *Fig.* 1. As this section shows, the thickness varies through the mold, depending on physical characteristics of the casting and type of metal being poured.

The process represents one of the

Fig. 1. Section through an assembled shell mold.

greatest foundry developments of modern times. While many small castings are produced by this method, such as adjuster nuts for steering components, bell bodies, etc., there are also intricate larger parts which are being produced by this method. The improved casting accuracy generally results in elimination of some machining operations. When machining is needed, the more accurate shell molded castings provide more positive chucking, higher cutting speeds, increased production and lower tool costs. Less metal is removed, also.

A major advantage of the shell-mold process is the reduction in the number of subsequent machining operations required to complete a part.

Surface finish is such that fine engraving can be duplicated and 250-300 microinch surface finish can be attained under controlled conditions. On some parts where contoured areas formerly required profile milling, shell castings have eliminated the need for this costly machining operation. Even when machining is necessary, over-all casting accuracy permits the use of minimum finish stock. This eliminates the need for roughing cuts on most surfaces and, in some cases, only a grinding operation is required.

Typical Production Shell Castings

A part for an automatic transmission, *Fig.* 2, was formerly made of aluminum die castings, but the steel piston rings

Fig. 2. Governor body casting (left) and machined part. Stock allowance on this and meeting bushing is 1/32 inch, and less.

used in conjunction with the aluminum governor body caused excessive wear in the ring grooves. It had not been possible in the past to cast these parts in gray iron because of the difficult coring involved. However, shell molding has made this a relatively simple job to cast, and several million of each part have now been produced.

Of special note is that a hole is cored completely through the larger casting, *Fig.* 2. The portion of the grooves cast by the core must be in perfect alignment with that made by the cope shell. The minor diameter of the core is $\frac{5}{16}$ in., and this diameter, machined to $\frac{3}{8}$ in. by the casting user, obviously allows little for casting or machining errors.

The production of automotive crankshafts, *Fig.* 3, by the shell process has permitted car manufacturers to increase maximum horsepower through increasing piston size and length of stroke without major changes in any of the other engine parts.

With a shell-cast crankshaft, it is now possible to flare the counter-weights to any desired width to achieve maximum balancing effect. Shell-cast crankshafts are produced with extremely narrow spaces between the counterweights. Another advantage is that draft angles of less than ½ deg are commonly used. All these factors make is feasible to produce the eight counterweight shafts, which many engineers favor because of their ability to decrease crankshaft deflection and main-bearing loads. With shell-cast pearlitic malleable iron, crankshafts can now be made even for the extremely difficult V-6 engine.

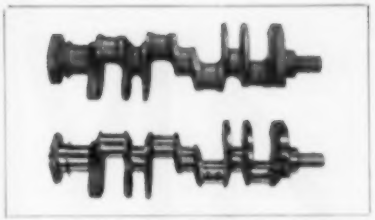
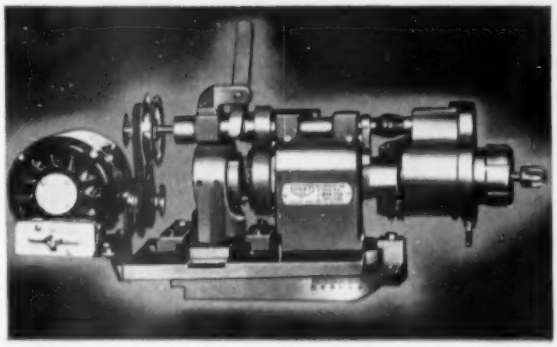


Fig. 3. Crankshaft molded by the shell process. Top shows casting before machining, weight 64 lb. Bottom, machined shell molding, weight 34 lb.

From the standpoint of machining, shell-cast crankshafts present substantial savings. On some designs, it is possible to eliminate the cheeking on the sides and the turning operations on the outside diameters of the counter-weights. When these machining operations are necessary to attain

Precision CIRCULARITY GRINDING ATTACHMENT

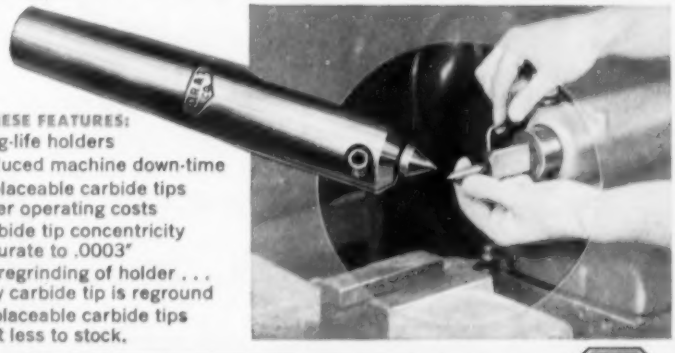


Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, a combination of form and radial relief, tapered cylindrical and straight cylindrical.

Model 500 Circularity Grinding Attachment is faster—easier to handle—has positive control—greater adaptability—rugged construction—is engineered and built to provide the finest precision work.

You Can Grind Tools Like These On A DETROIT REAMER CIRCULARITY GRINDING ATTACHMENT

Grip-Tip CENTERS–Replaceable Carbide Tips



CHECK THESE FEATURES:

1. Long-life holders
2. Reduced machine down-time
3. Replaceable carbide tips lower operating costs
4. Carbide tip concentricity accurate to .0003″
5. No regrinding of holder . . . only carbide tip is reground
6. Replaceable carbide tips cost less to stock.

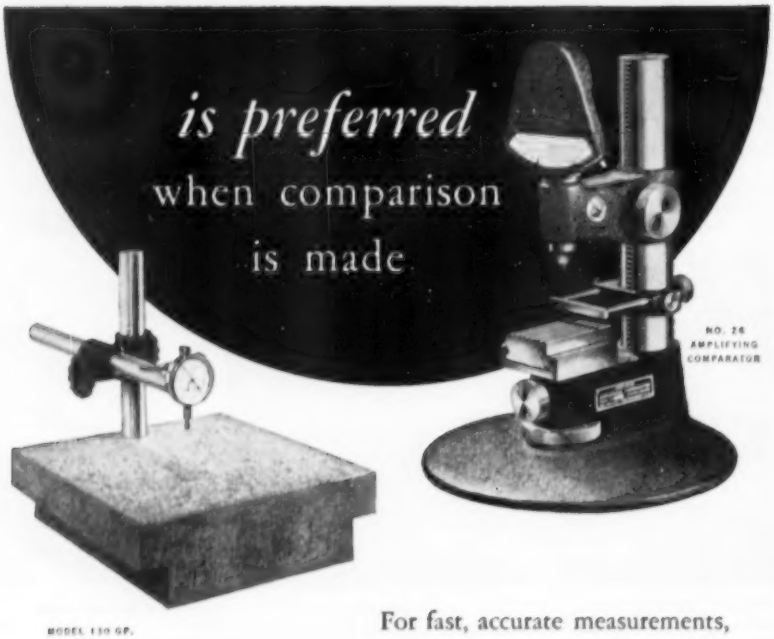
DETROIT REAMER & TOOL CO.

780 WEST MAPLE ROAD • P.O. BOX 174 • BIRMINGHAM, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A-4-225

AMES

is preferred
when comparison
is made



MODEL 130 GP.

For fast, accurate measurements, Ames Dial Comparators are the choice of quality control men everywhere. You get definite, impersonal readings directly from the dial. There's no guesswork or figuring.

Special comparators are available for measuring resilient materials such as rubber, paper, etc., and for measuring non-yielding materials such as sheet metal, glass and plastic. Write for complete details.

Representatives in principal cities

B.C. AMES CO.

30 Ames Street, Waltham 54, Mass.

MANUFACTURERS OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-226

maximum counterweight thickness and diameter, only a minimum of stock need be removed.

Conclusions

Shell castings generally are slightly more costly than conventional green-sand castings, mainly because of the phenolic resin used as a mold binder. Considerable research work is under way to develop new and less expensive binders which reduce this cost. Even at the present resin cost, some castings can be produced at a cost comparable to, or lower than, green-sand castings. This is particularly true when cores can be eliminated.

From a paper No. 56-A-94 given at the 1956 Annual Meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Human Engineering Cuts Industrial Accidents

By Theodore F. Hatch

Professor of
Industrial Health Engineering
University of Pittsburgh, Pa.

Machinery, which today causes one third of the permanent partial injuries suffered by industrial workers will become an even more important factor in accidents and injuries as mechanization and automation are stepped up. To minimize the likelihood of human errors, it is necessary to design machinery to that end. Among factors contributing to accidents are poor lighting, excessive noise, vibration, monotony of operation and failure to adapt machine dimensions to human dimensions.

Pushing the wrong switch button among a battery of identical buttons reflects an engineering rather than an operator failure. A truck accident resulting from failure to apply brakes soon enough may be caused by restricted leg room for the driver, as well as by inattention to the job.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Engineers must take the lead in translating information from the biosciences into useful terms for engineering application.

Lack of an adequate body of knowledge of human capacities and behaviors can be attributed to two factors:

failures of engineers to achieve a deep understanding of the anatomical, physiological and psychological problems involved; and failure of bioscientists to recognize the need to work with industrial engineers on the problem.

The solution may lie in a field of activity born during World War II and known as human engineering.

It is built upon the basic sciences of anthropometry, physiology, psychology and related fields. Of particular significance to engineers in this development is the repeated demonstration of quantitative relationships between external stress and human response, many of which can be accounted for on a national basis and even expressed in terms of biological equations.

From a paper, No. 56-A-46, given at the annual meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y., November, 1956.

▼ ▼ ▼

Plastics For High Temperature Use

By Gerald E. Dodson
Engineering Supervisor
H. I. Thompson Fiber Glass Co., Inc.
Los Angeles, Calif.

Missiles and aircraft are beginning to approach a velocity that has the designer wondering what materials he will have available to withstand the terrific heats generated by surface friction. In a number of applications, where severe temperature resistance is required, plastic materials have been replacing metals. The prime reason why plastic materials have been successful in withstanding extreme temperatures for short periods of time is due to the high specific heat of the resinous materials. Physical properties of plastics have also been of tremendous significance in allowing the materials to be used in applications contributing to structural integrity of aircraft components.

Perhaps the most commonly used plastics for high temperature applications are phenolic resins. They have been used with glass, asbestos and refractory reinforcements.

Silicone resins have been showing increasing possibilities because of new curing methods. They have been used with both glass and asbestos, although they have shown tendencies to deteriorate laminates made up using refractory reinforcements. New finishing methods and control of residual acidity has shown promise of better results.

Some new high temperature epoxy resins have been showing much promise due to higher physical properties and ability to take great temperature shock. These materials may make possible parts at much lower tooling costs, since they can be cured at contact pressures. High temperature polyesters have been used in applications where electrical transmission is required through parts subjected to high temperatures.

In order to fully appreciate complexity of design applications of materials subjected to these temperatures, one must become acquainted with the many variables affecting both temperature and erosion resistance of these materials. There are many more resins and combinations that might be used in these applications. The difficulty of processing or lack of knowledge as to physical properties have excluded them up to present, however.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

At best, results from reinforcements are somewhat confusing. In thin laminates, asbestos materials have proved superior under tested conditions. Contrarily, better results have been obtained with chopped glass fabric coated with phenolics in thick parts. Amazing results have been obtained using refractory reinforcements where it is desirable to protect a metal surface from pure heat.

Some results obtained at present include successful resistance to temperatures in excess of 10,000 F for short periods of time; controlled erosion after molding starts to burn.

Many applications have proved satis-

MELIN
MELIN
MELIN
MELIN
MELIN
MELIN
MELIN
END MILLS
There is a difference in end mills . . . MELIN end mills! Proof of this is evident in the continued increase in MELIN popularity. The growth in MELIN tool acceptance was by no means an accident . . . The secret is in CONSISTENT QUALITY. This standard of Quality assures you better performance . . . longer lasting performance . . . CONTINUOUSLY . . . from one shipment to another. Next time you order end mills . . . specify the finest . . . specify MELIN.
MANUFACTURED IN TWO, THREE AND FOUR FLUTE TYPES.
Representatives in principal cities.
MELIN TOOL COMPANY, INC.
3372 West 140th Street
Cleveland 11, Ohio
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-227

Get finer accuracy plus
a guaranteed wear factor
at no additional cost!

Ellstrom chromium plated gage blocks are now unconditionally guaranteed to be "minus nothing" from nominal size in accordance with these exclusive new standard accuracy tolerances . . .

Ellstrom Gage Block Accuracy Guarantee

"W"—WORKING ACCURACY BLOCKS
Measured Length: +.000008"/—.000000"
Parallelism: .000004"—Flatness: .000004"

"I"—INSPECTION ACCURACY BLOCKS
Measured Length: +.000004"/—.000000"
Parallelism: .000003"—Flatness: .0000003"

"L"—LABORATORY ACCURACY BLOCKS
Measured Length: +.000002"/—.000000"
Parallelism: .000001"—Flatness: .000001"

• Available in standard sets of from 8 to 92 blocks in both square and rectangular styles with or without basic gage block accessories. Write for prices today!

Never before have gage blocks been offered as standard with all deviations unconditionally guaranteed to be on the "plus" side of nominal block size. And never before have you been offered these three exclusive benefits:

1 Positive assurance against receiving "minus" blocks . . . blocks that are actually "worn" undersize during manufacture before they are ever used.

2 A basic built-in wear factor equivalent in millionths to the full minus tolerance invariably specified as standard for all other makes of blocks.

3 An absolute guarantee that every new Ellstrom gage block will start wearing *toward* its nominal marked size rather than *away* from it.

Bear this in mind, too. These are Ellstrom *Standards*, not special blocks. And they are available now at no increase in price to bring you even finer accuracy, longer useful life, and lower gaging costs.

ELLSTROM STANDARDS DIVISION
DEARBORN GAGE COMPANY
"Measuring in Millionths for Three Generations"
22038 Beech Street • Dearborn, Michigan

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-228

factory in the 4000 to 5000 F temperature range. Such parts as fins, motor liners, control surfaces, guiding vanes and heat barriers are typical. These parts have been exposed at times up to one minute in duration and at erosion velocities equal to Mach 4 and 5.

All of these applications and known results point to the need for a great deal of new and more comprehensive studies relating to interaction of effects of the variables resulting from manufacture. While much more needs to be learned the preliminary uses indicate that this may be a very promising field for many types of plastics.

From a paper given before the 1957 annual meeting of the Reinforced Plastics Division of the Society of Plastics, Inc. 250 Park Avenue, N. Y. 17, N. Y.

▼ ▼ ▼

Maintenance in Small Plants

By William C. Wallin
Chief Plant Engineering Dept.
Western Electric Co., Inc.
Winston-Salem, N.C.

Maintenance in small plants is a creative challenge because of many conditions that are not found in larger plants, such as problems arising from management, personnel and operating practices.

During recent years top management has been increasingly focusing attention on better methods to improve the execution of plant maintenance. It is highly important since plant and equipment maintenance costs now average more than 5.0 percent of the net sales dollar for more than 50 major industries.

Average maintenance expenses continue to increase rather than decline. Increased mechanization, the push button plant, higher speeds, higher pressures and temperatures, new materials handling equipment, instrumentation, electronics, while reducing direct labor, increase and further complicate the maintenance problem.

Management methods and control devised for production operations must also be applied to maintenance. The opportunities for cost reduction in the maintenance departments of industries is substantial and one that should receive constant attention.

Proper organization for maintenance should be designed to:

1. Reduce excessive clerical work on part of crafts and supervision
2. Minimize travel time

3. Promote versatility in maintenance crafts
4. Provide close coordination between maintenance and production departments.

In considering planning and scheduling, few companies plan their maintenance work to the degree that they plan their production. Many operate on the fire house principle. Maintenance planning can be both practical and highly effective. Experience has shown that planning the work of maintenance craftsmen and crews will improve man and machine effectiveness as much as 10-30 percent. In the average industrial plant, 80 percent of the maintenance work load can be planned in advance.

Maintenance work can be scheduled from day to day in much the same way as production operations are planned. The important consideration is to provide the foreman with a means whereby he may attain maximum utilization of available manpower and equipment, make adequate preparations for tools and parts, and to plan his work so that production operations are interrupted to the least extent possible.

An effective program for productive maintenance requires careful study of property, machinery and equipment. To a degree, breakdowns can be anticipated and repairs and overhauls can be performed on a planned basis. The major factors in productive maintenance are scheduled inspections and lubrications, coupled with timely minor repairs thus preventing large-scale repairs. Basically, the following procedures are necessary to install a satisfactory maintenance plan:

1. All machinery and equipment should be numbered for identification
2. Equipment record cards should be maintained for each piece of equipment, including motors, showing date of installation, hp, name plate data, costs and other pertinent data
3. Equipment record cards, or equivalent should be kept in open file. Each card should indicate inspection and lubrication frequencies,
4. Routine inspection and oiling routes should be determined, clearly defined and scheduled
5. Repair costs should be analyzed at specified intervals permitting management to determine whether:
   Routine inspection and oiling frequencies are correct, or
   A major repair job is required, or
   It is more economical to replace equipment concerned.
6. Complete set of equipment records should be kept—running record of the repair history and repair costs on all major pieces of equipment.

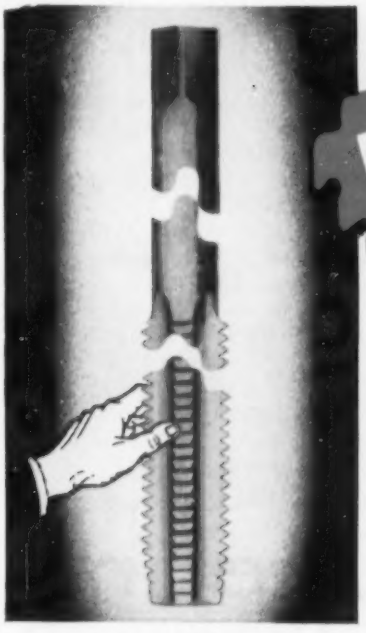
Maintenance costs by departments are important for comparative purposes, as well as being a direct aid in establishing budgets. Reports, however, should be simple, informative, and factual.

Incentives can be applied to maintenance work to secure the added cooperation of the maintenance employees. Particularly, where incentives for production employees exist, a company may find it highly desirable to provide incentive opportunities to maintenance and other indirect employes. The productivity measurement feature afforded by time standards provides a basis for incentives and a means of sharing cost reductions with maintenance employees.

Down time is highly important as a standard against control. In some plants, the effectiveness of both production maintenance and work scheduling may be measured by the operating performance of certain key units.

Maintenance, as a function, ordinarily should be responsible to the plant engineer. The plant engineer should not be a part of the plant production organization. The reason is obvious; it's not a human trait to report one's own faults or failures to top management. Separation of production and maintenance-engineering forces will serve to keep management informed of such things as improper use of equipment or inadequate lubrication. A maintenance superintendent or foreman may or may not be needed under the engineer, depending on the plant's size.

There are two types of maintenance



PUZZLED?
OVER TAP PERFORMANCE

YOU GET ONLY
1/2 A TAP
WITH SINGLE TEMPERING

3/4 A TAP
WITH DOUBLE TEMPERING
(industry standard)

YOU GET FULL VALUE TAPS
WITH SOSSNER TRIPLE TEMPERING

The mark of Triple Tempering

Triple Tempering—a standard with Sossner—delivers a tougher, more reliable, longer lasting tap...less chipping...less breakage.

OTHER SOSSNER EXCLUSIVES
- elektraLUBE... A permanent Super-Lubricant
- SPIRAL FLUTED TAPS... The most complete line

For FULL VALUE TAPS insist on SOSSNER.

SOSSNER TAP & TOOL CORPORATION
29 BROADWAY, LYNBROOK, L.I., N.Y.
FACTORY WAREHOUSES IN NEW YORK AND LOS ANGELES • DEALER STOCKS IN OTHER CITIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-229

Increase output . . . reduce costs!

Costly, time-consuming trimming and notching operations can be done in one operation with a Brehm Trimming Die. Don't worry about stock thickness. Edges will be of full thickness—clean, flat, without burrs or distortion at the trimmed edge.

Other Brehm Die advantages! **Workable Materials**—gold, silver, stainless or mild steel, copper, brass, zinc, aluminum, fiber, rubber, plastics. **Quantities vary**—stove or refrigerator doors, auto bumper buffers or typewriter covers, from 264 to 900 per hour. Intermediate parts, where stock and scrap can be blown from the die, about 1200 per hour. **Shapes**—fountain-pen ferrules, artillery cases, watch cases, burial vaults, automotive, kitchen, radio and television accessories and parts. Almost anything *you* need trimmed.

A Brehm "Shimmy" Trimming Die with angular cams, cuts four ways in one press stroke, handling straight or curved edge contours, with multiple notches and projections. Slow, costly "horn" and "pinch" trimming operations, are eliminated.

Submit part prints of not only the shell to be trimmed but for all related dies for our quotation.

THE "SHIMMY" REG. DIE

Brehm® TRIMMING DIES

SERVICES OF

YOUR TOOL ROOM in DAYTON

Engineering Processing Building

Tools . . . . Dies . . . . Special Machines

Vulcanaire Jig Grinders Motorized Rotary Tables

Brehm "Shimmy" and related dies. Automation

VULCAN TOOL CO. 733 Lorain DAYTON 10, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-230

work: corrective maintenance and productive maintenance. Corrective maintenance is the repair of breakdowns or the work most people wait for and call the cost "maintenance." Productive maintenance involves any repetitive function, such as inspection, adjustment, cleaning, lubrication, etc., that can be controlled by schedule.

Of the two types, preventive or productive maintenance is the more important. It substitutes the labor cost necessary to hunt up and correct minor troubles, for the cost of waiting until they become major breakdowns and require expensive repair jobs.

From an address given at the Plant Maintenance and Engineering Conference, held in Cleveland, O., January, 1957. Under management of Clapp and Poliak, Inc., New York, N.Y.

▼ ▼ ▼

Where To Use Silicone Protective Coatings

By R. C. Hedlund

Supervisor
Coatings Lab.
Product Development Lab.
Dow Corning Corp.
Midland, Mich.

Silicone coatings have found wide use as finishes for steel equipment which operate at high temperatures and are exposed to weathering.

A number of commercial coatings are available for use on stacks, mufflers, and manifolds to temperatures of 1000 F. Others are used as industrial coatings and as maintenance finishes.

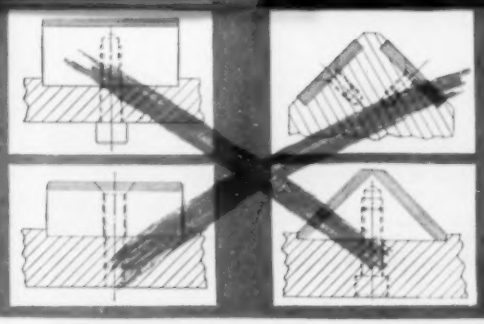
The physical properties of silicone finishes are similar to organic coatings but their properties are quite different.

A wide variety of silicone resins are available to the paint manufacturer for use in protective coatings. There are many surface preparations and applications where silicone coatings are being used successfully for steel and other surfaces.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

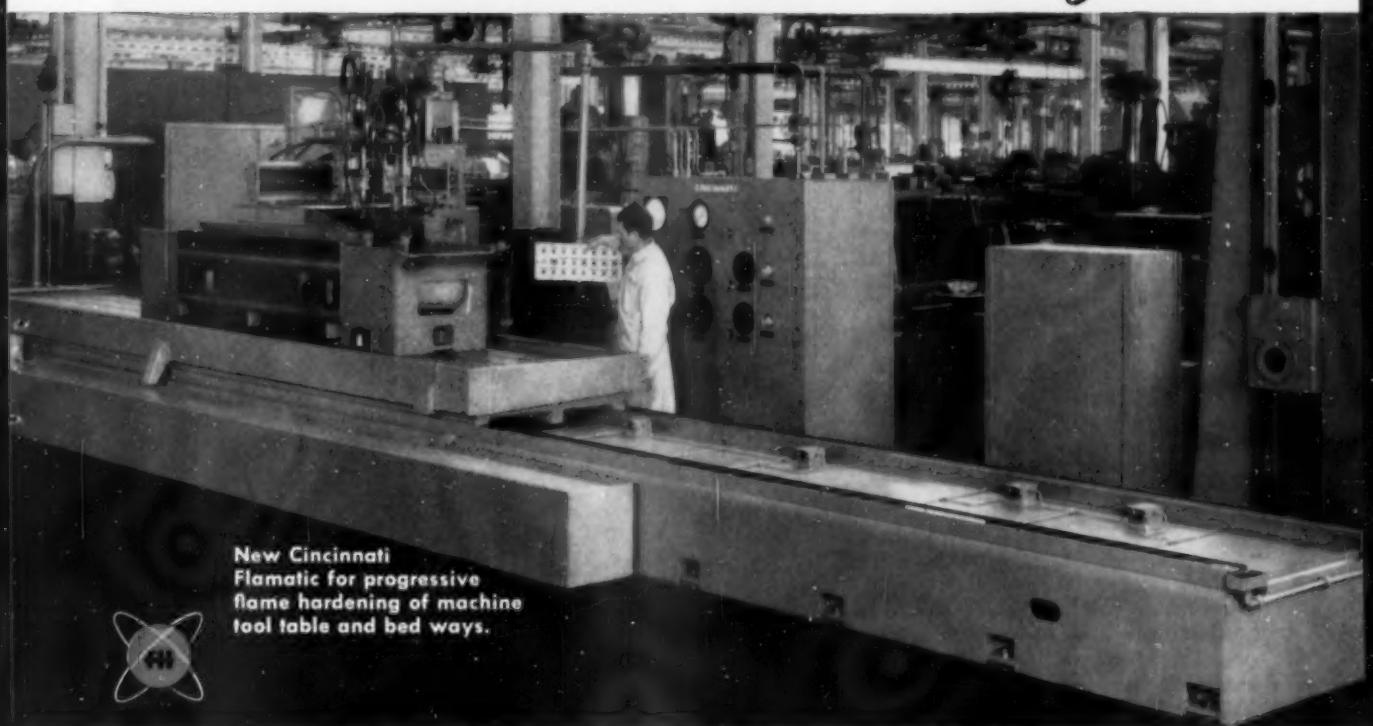
From a paper presented at the 1956 Assn. of Iron & Steel Engineers Convention. Address 521 Oliver Bldg., Pittsburgh 22, Pa.

United States industry is spending only four percent of its research and development funds on pure research—Dr. Alan T. Waterman, Dir. Nat'l. Science Foundation.



eliminate costly ways to get hardened ways...

use the **flamatic** *way!*



New Cincinnati Flamatic for progressive flame hardening of machine tool table and bed ways.

Cast iron machine tool table and bed ways are now being surface hardened on this new Cincinnati Flamatic®. Uniform hardness of Shore 75-80 is achieved. This Flamatic method results in substantial cost savings over methods currently employed of fastening hardened steel wear strips or sheets to cast or welded components in sliding contact.

The reciprocating work table of the Flamatic can accommodate castings up to 20 feet long x 44 inches wide x 40 inches high, on which integrally cast ways are to be hardened. Table feed is infinitely variable between 3" and 15" per min., and rapid traverse is at 25 ft. per min. Flame heads are mounted on a rail, powered for rapid positioning of the flame heads to the ways to be hardened. The flame head assembly includes water spray quench and a tracer mechanism, which at all times maintains the prescribed gap distance of the flame from the way . . . compensating for any distortion of the casting.

Oxy-acetelyne fuel gas is used; however, the unit will operate on propane or natural gas. Complete operating controls are located on a pendant station. Flame hardening of work such as columns, rolls, long bars and shafts, which can be held between centers on the table, is also accomplished.

Check into Flamatic surface hardening for savings in your production processes. Call in a Process Machinery Division field engineer.

CINCINNATI

flamatic and inductron

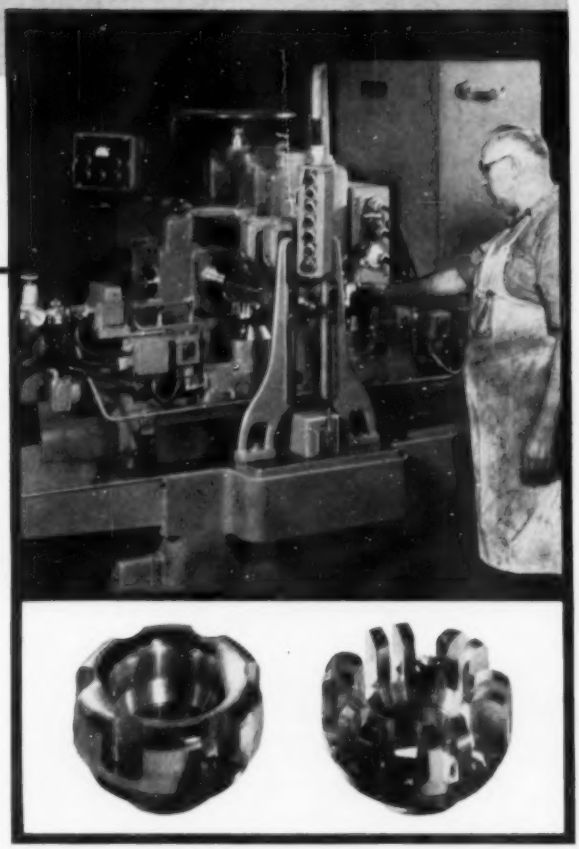
hardening machines

PROCESS MACHINERY DIVISION

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

Improve milling methods and Rigidmils and



Determining the most profitable processing method, then selecting the machines to suit this method—that's Sundstrand

"Engineered Production"

at work.

A high percentage of milling problems are solved with standard or semi-standard machines but, when necessary, entirely special machines will be designed and built. The important fact is: *Sundstrand designs and builds all three types of machines,* assuring you of always getting the best machine for your part design and production requirements.

These three examples illustrate the application of Sundstrand "Engineered Production" to three milling problems using: (1) a standard Rigidmil, (2) a semi-standard Rigidmil (standard machine equipped with special or multiple-spindle head), and (3) special Rigidmils. Whether your milling job is similar to any of these shown, or the part differs completely in geometry and size, the broad processing experience of Sundstrand engineers enables them to offer the most practical method for your job. Ask for a Sundstrand "Engineered Production" analysis of your milling job. There is no obligation for this service.

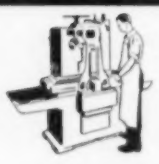
ADDITIONAL DATA on "Engineered Milling Production" is available in Bulletin No. 778. Write for your copy today.

Milling Aluminum Forgings on a Standard Rigidmil

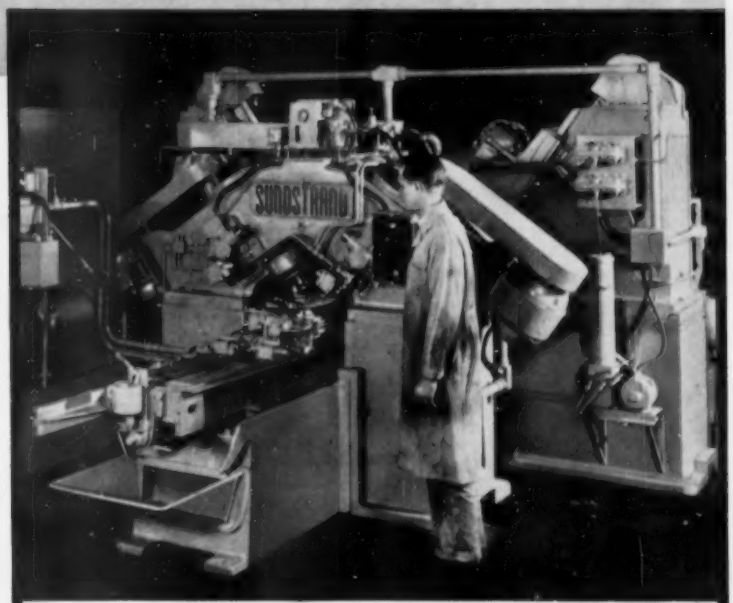
A Sundstrand Model 22 Rigidmil with standard equipment arbor mills six lugs on aluminum forgings, two in each cut of an automatic cycle that includes indexing of the work. The two-way feed table mounts a three-division index base and workholding fixture at each end, enabling operator to unload and load one fixture while the other is in cutting position. Production is 113 parts per hour.

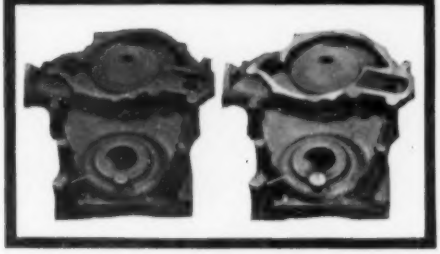
SUNDSTRAND "Engineered Production" Service* *REG. U.S. PAT. OFF.

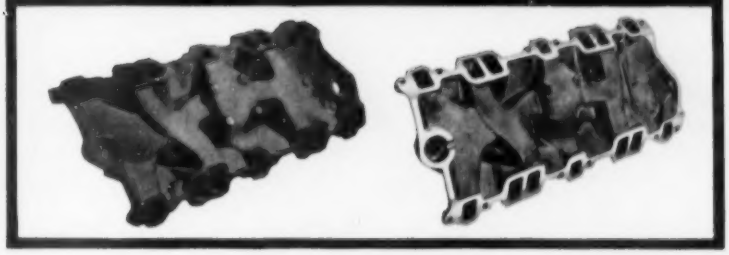
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



cut costs with Sundstrand "Engineered Production" service!



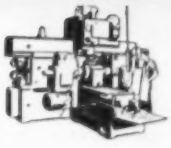


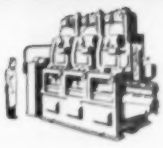


Semi-Standard Rigidmil Mills at Two Depths Simultaneously A Vertical Rotary Rigidmil equipped with special three-spindle head ruffs and finishes the large pad on this casting and, in addition, takes one cut on the small pad at a different depth. Unusual part configurations like this one shown are among the processing problems that can be overcome with semi-standard Rigidmils.

Multiple Surfaces Milled and Drilled on a Special Rigidmil The milling and drilling of port faces and bottom pads on 43 automotive manifolds per hour is performed on this multi-spindle special Rigidmil. One vertical and two angular spindles are mounted in the head bridging the table at the front. A 4 spindle vertical drill head is mounted between two 6 spindle angular drill heads at the rear. Machining operations are performed during both the forward and reverse feed strokes of the table.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.

"Engineered Production" Service

FOR BROACHING

It takes all 3

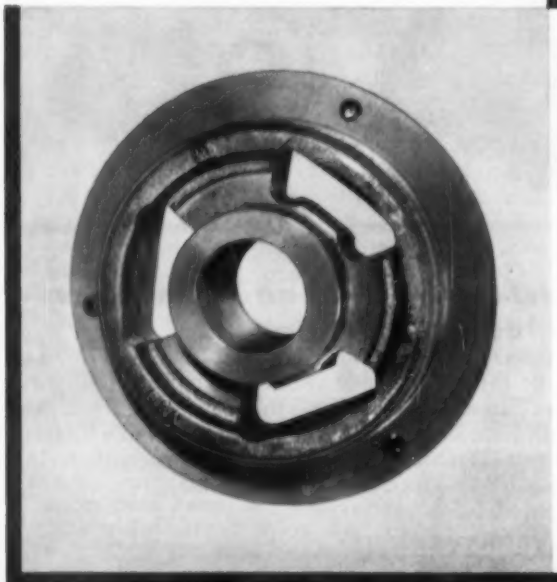
AMERICAN'S "ENGINEERED PRODUCTION" SERVICE . . . gives the broach-user the complete three-part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

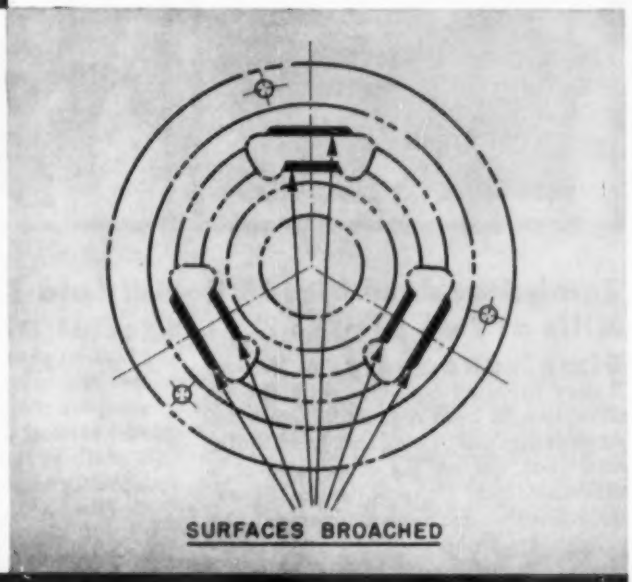
THE JOB — Broaching the flats and chamfer in the three slots of a differential center wheel. Moderate production rate required.

THE RESULT—40 completed parts per hour (a total of 120 slots) broached on a hydraulic horizontal machine. Part is indexed while broach is being returned to starting position for the next cutting stroke.

1 PROPER BROACH TOOL DESIGN

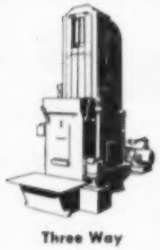
Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers stock removal, length and width of cut, finish, tolerances required, etc. American's experience in designing and building broaches for every type of part capable of being broached pays off in quality of work and in long tool life. You can be sure the broach and machine will operate as a team because they are designed that way.



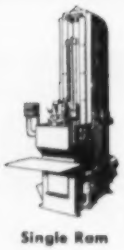


SURFACES BROACHED

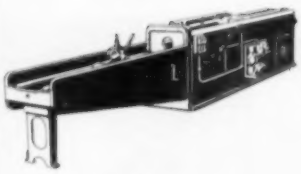
Broaching Tools



Three Way

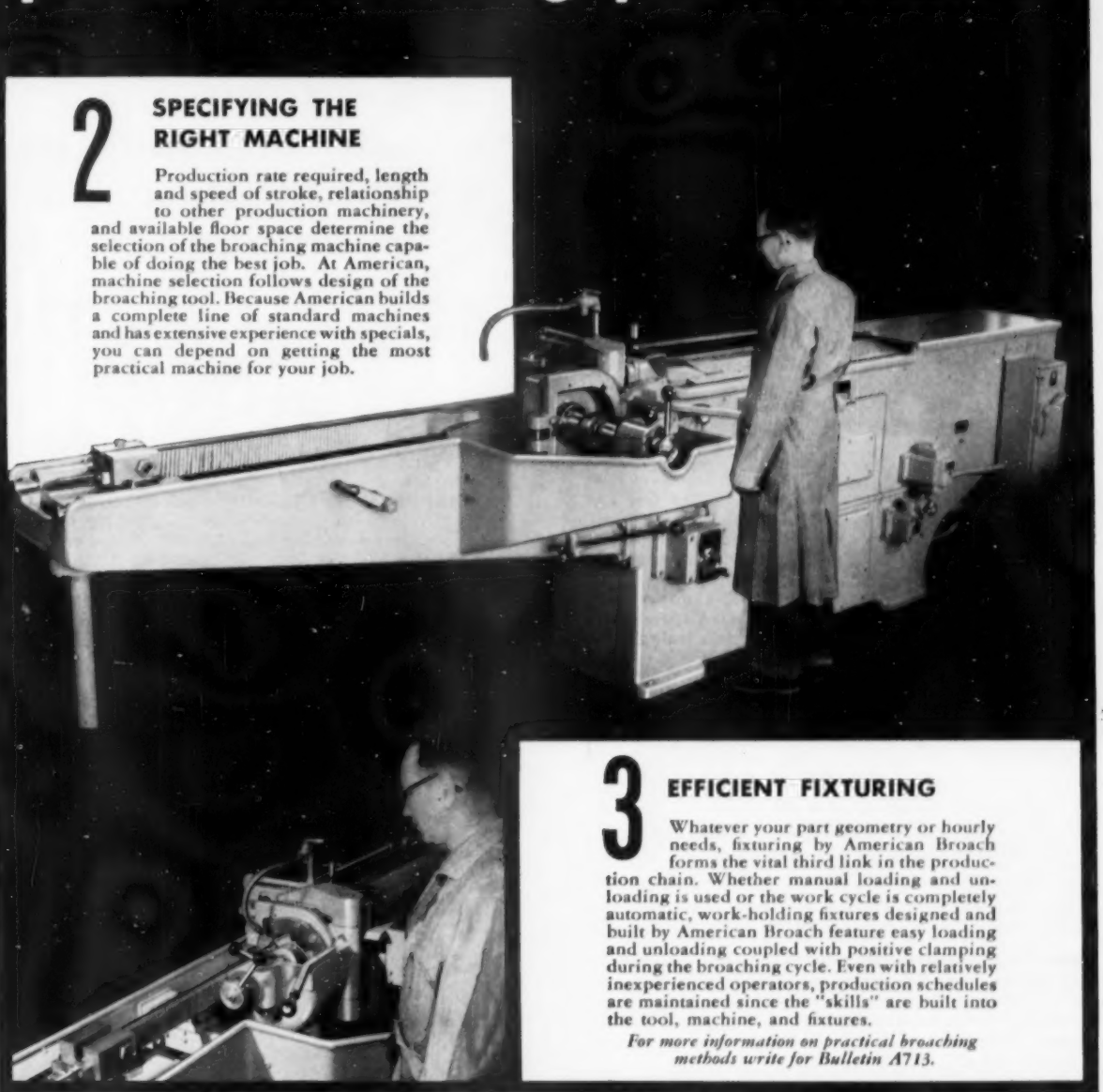


Single Ram



Horizontal

to give you peak broaching performance



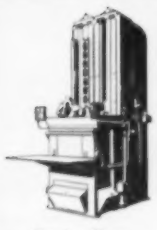
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, and available floor space determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. Because American builds a complete line of standard machines and has extensive experience with specials, you can depend on getting the most practical machine for your job.

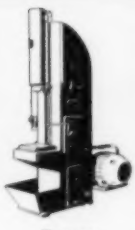
3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Whether manual loading and unloading is used or the work cycle is completely automatic, work-holding fixtures designed and built by American Broach feature easy loading and unloading coupled with positive clamping during the broaching cycle. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.

For more information on practical broaching methods write for Bulletin A713.



Duplex Ram



Presses

SUNDSTRAND

American

BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

ROCKFORD, ILLINOIS

AT CANADIAN PRATT AND WHITNEY AIRCRAFT...

ALMCO barrel finishing SAVES 97% on deburring and finishing of spark plug bushings

CUTS DEBURRING AND FINISHING COSTS $2,430 — Threaded spark plug bushings used in famous Pratt & Whitney aircraft engines will be deburred and finished for $2,430 less this year with Almco equipment and processes. Maurice Harrison, Supervisor of Process Planning, shows the small part on which this savings will be made.

● SAVES .10125 ON EACH BUSHING—Deburring and finishing threaded spark plug bushings like the one shown at the left, formerly cost $104.20 per thousand when CP & W used speed lathes, portable power tools and other hand methods.

After installing two ALMCO DB-200 Supersheen units, records showed a cost cut of 97%. This equipment turns out 1,000 bushings in 45 minutes, releases grinders and finishers to other duties. Cost reports showed:

$104.20	cost per thousand with power tools.
2.95	cost per thousand with 2 ALMCO barrels.
$101.25	Savings per thousand pieces.

This year CP & W will process 24,000 spark plug bushings, *with a total savings of $2,430 on this one part alone.*

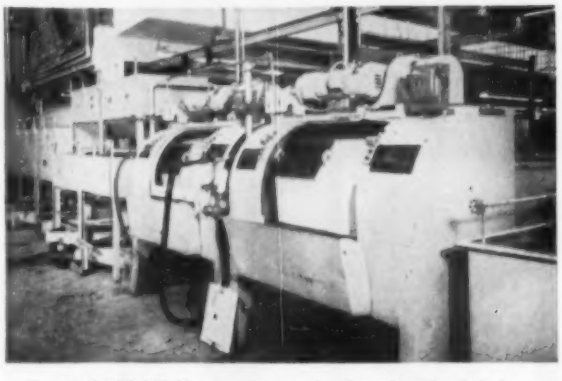
PRACTICALLY ELIMINATES REJECTS—Before installing controlled-type barrel finishing, parts inspectors returned for re-work an average of 125 bushings out of every 1,000 (12½%). With Almco Supersheen equipment and processes, these parts are now finished to a degree of uniformity that is virtually free of rejects.

DESIGNED FOR MANY METAL FINISHING OPERATIONS—In addition to deburring and finishing, ALMCO equipment and processes are used for descaling, degreasing, grinding, burnishing, work-hardening, rust-inhibiting, polishing, etc.

ALMCO has facilities throughout the United States for running sample parts. Write us on your letterhead for the address of an Almco sample processing laboratory or branch office in your area. Your sample, with your specifications, will be handled promptly. You'll get a complete report on where you can save deburring and finishing costs, how you can improve product quality and appearance, and what method and unit is best for your operation. Or, if you prefer, ask an Almco sales engineer to call you.

SEND FOR FREE 52-PAGE BOOK

Full of facts and processes on barrel finishing. Includes detailed cost chart on finishing of typical parts. Send for your copy today.



Two Model DB-200 Almco machines, using Supersheen bonded abrasive chips and compounds, deburr and polish 1,000 spark plug bushings in 45 minutes at Canadian Pratt and Whitney.

ALMCO

DIVISION OF QUEEN STOVE WORKS, INC.
184 Marshall Street • Albert Lea, Minnesota

Sales and Engineering Offices in Chicago, Detroit, Los Angeles, Newark, New Haven, Philadelphia and London, England

VANADIUM-ALLOYS STEEL COMPANY

FIRST QUALITY

High Speed Steels

wherever **outstanding cutting performance**
must be matched with **practical**
economy on industry's most exacting jobs

Vasco Supreme — The supreme high speed steel, providing highest hardness, highest hot hardness, highest wear resistance, highest cutting efficiency. (U.S. Pat. 2,174,285)

Neatro — For heavy, light and intermittent cuts on heat-treated steels and abrasive materials. Extremely high abrasion resistance, exceeded only by Vasco Supreme. (U. S. Pat. 2,174,286)

Van Cut — Molybdenum-tungsten type, combining ease of grinding with improved wear and heat resistance. Suitable for all types of cutting tools.

Red Cut Superior — America's favorite general-purpose high speed steel. Easy to fabricate, simple to heat treat. Wide choice of carbon content, for almost limitless uses.

Vasco M-2 — The original 6-6-2 type steel. Machines easily, has wide hardening range, can be ground normally when hardened. Excellent economy in general service.

8-N-2 — Molybdenum type, low in tungsten. High toughness, for fine edged tools and sharp angles without chipping or crumbling. Substitutes well for 18-4-1.

Van-Lom — Out-cuts other high-moly steels. Special vanadium content permits increased carbon (U. S. Pat. 2,105,114) without brittleness, for greater toughness, wear resistance.

Write for useful Data Sheets

Vanadium-Alloys Steel Company

Latrobe, Pennsylvania

SUBSIDIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni

NO ONE IS AMAZED AT JUNIOR ANY MORE . . .

LOOK . . . . NO HANDS

. . . when VFC fed the production line one-half million parts per hour WITHOUT HANDS . . . . . INDUSTRY MARVELED!

Successful automatic production depends on the uninterrupted delivery of components properly positioned and perfectly timed. Engineering and feeder know-how will help you accomplish this better in the least possible time. VFC is an authority in small parts feeding . . . Better production through better parts feeding is their business. If you want to produce more, write, wire, or call VFC.

VFC . . . . *VERY FINE CRAFTSMANSHIP*

VIBRATORY FEEDER COMPANY

32nd and BRANDES STS., ERIE, PA. • • PHONE 4-6320

Division of Automation Devices, Inc.

REMEMBER:

Vibratory Feeder Company is a manufacturer of basic feeder and bowl equipment for the industry . . . . . .

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-238-1

THIS REVERSE STAMP

IS A FORWARD STEP!

Hoggson Brand Reverse Stamps are designed for stamping molds for making rubber, plastic and glass products and for marking die sinking molds and forming dies.

Made of high alloy steel, specially heat treated to withstand continuous impact, they are made for marking flat or contoured surfaces, and are GUARANTEED ACCURATE.

Available from stock in letters and figures from 1/16" to 3/8", Hoggson Brand Reverse Stamps are also supplied, hand cut to your order, as symbols, trademarks, or other special designs.

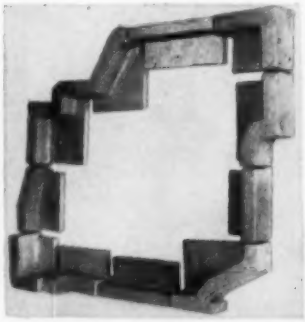
Specify Hoggson Brand Reverse Stamps. They're a step in the right direction!

HOGGSON & PETTIS MANUFACTURING CO.
144 Brewery Street New Haven 7, Conn.

USE READER SERVICE CARD; INDICATE A-4-238-2

COMPOSITE DIE SECTIONS

"Electrically welded for complete bonding" — "made to your specifications and dimensions" — mean safety, economy and versatility in die construction.



Typical layout of Composite Die Sections.

Proved in automotive body die construction . . . becoming more popular every day for other industries. **Let us tell you why.** Write for FREE book containing "Engineering Data."

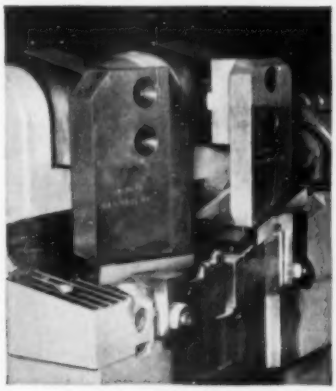
COMPOSITE FORGINGS, INC.
2300 W. JEFFERSON, DETROIT 16, MICH.
Phone TAshmoo 5-3226

USE READER SERVICE CARD; INDICATE A-4-238-3

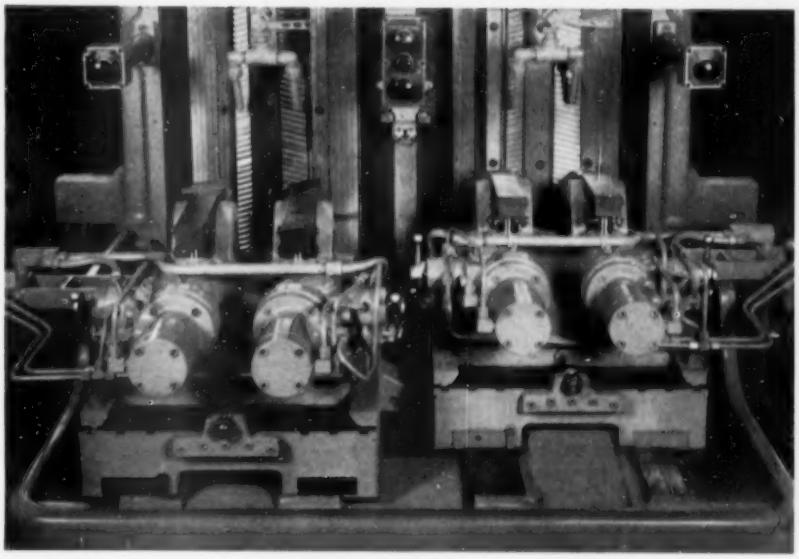
TWO CINCINNATIS

broach 134 SIZES of Tool Bits

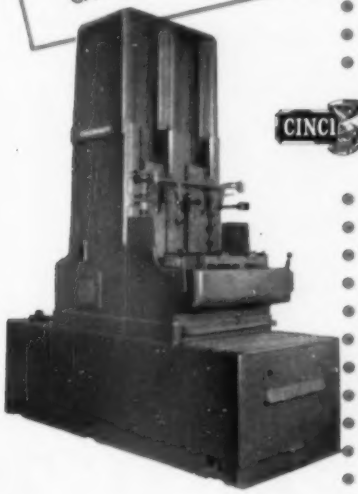
in 65% Less Floor Space



Two tool bits clamped in position, as seen by the broaching cutters. The top relief will be broached on one of these blanks and the side relief on the other.



CINCINNATI No. 10-66
DUPLEX VERTICAL
HYDRO-BROACH MACHINE
CATALOG No. M-1848



Doing more work in less floor space releases it for other productive equipment; reduces fixed cost. Two CINCINNATI® Hydro-Broach Machines save 65% of the floor space formerly required by the old equipment to machine 11 styles of tool bits in 134 sizes. These two Hydro-Broach machines, both of 10-ton capacity, were tooled up by Cincinnati broaching specialists with hydraulically operated, progressive type fixtures. All tool bits are broached complete from a common shape of blank.

This Cincinnati two-machine production team averages 800 completely broached parts per hour.

You may not be directly interested in the manufacture of tool bits, but you will be interested in what CINCINNATI Broaching Machines and Engineering Service can do to reduce your manufacturing costs (and perhaps fixed costs, too). May we hear from you? Meanwhile, you might want a copy of our latest Duplex Hydro-Broach catalog. Brief specs will be found in Sweet's.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES · BROACHING MACHINES · CUTTER AND TOOL GRINDERS
METAL FORMING MACHINES · HARDENING MACHINES · OPTICAL PROJECTION
PROFILE GRINDERS · CUTTING FLUID · GRINDING WHEELS

FOOTBURT

STATION TYPE MACHINES

PROGRESSIVE PRODUCTION...

With the Station Type Machine, Footburt continues to provide the most modern developments in production machinery.

Drilling, reaming, tapping, milling, checking and testing may be combined in one station type machine, and units may be mounted at any angle.

Installations of Footburt Station Type Machines have been made in many leading automotive plants, in some case handling the major machining on the block and head components.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building

19 Station — 115 Spindle
Drilling and Milling Machine

engineered for production

FOOTBURT

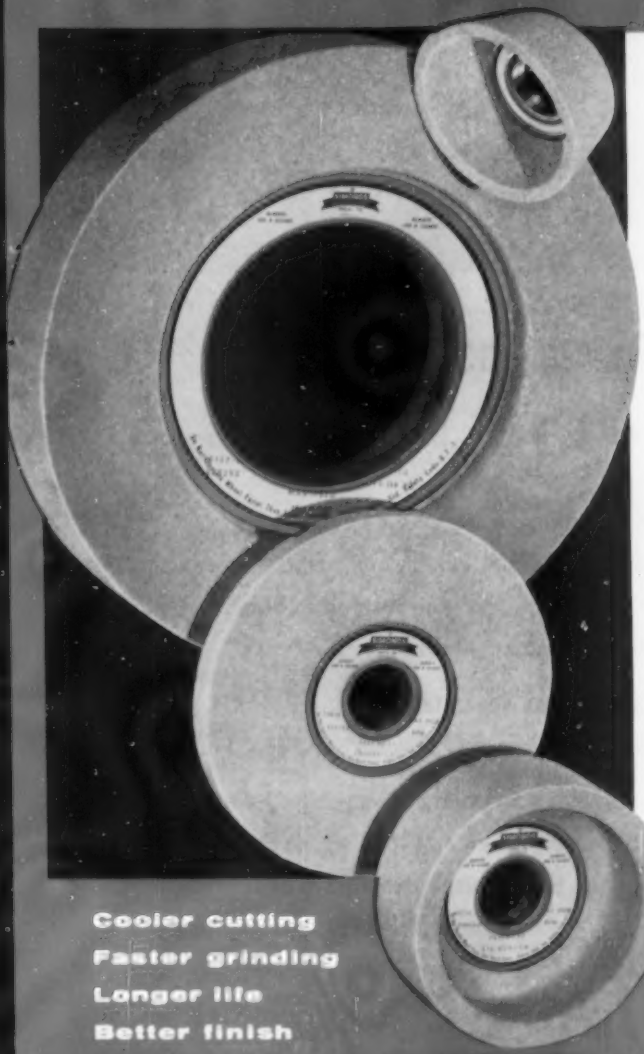
MACHINE TOOLS

New and Radically Different

SIMONDS SA *Borolon*®

TRADE MARK

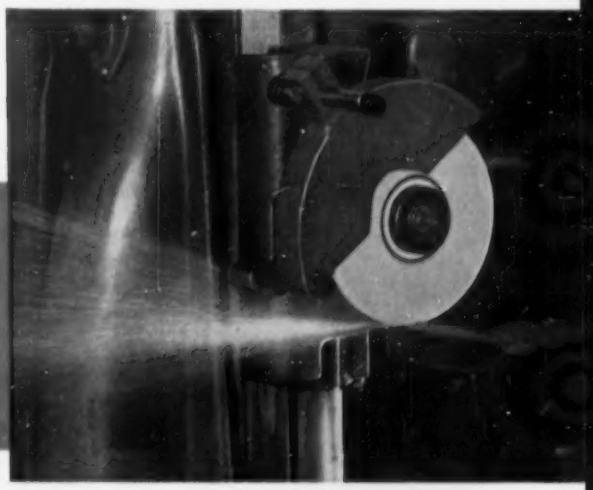
Grinding Wheels for Toolroom use



SA Borolon is a single crystal aluminum oxide abrasive possessing superior qualities over conventional white aluminum oxide abrasive. It is produced from a furnace charge consisting of a molten base with a soluble matrix which dissolves, leaving single, natural crystals of abrasive grain *without crushing*.

SA Borolon is tougher because it is free of the inner strains to which crushed abrasive is subjected. It penetrates deeper and cuts faster because each abrasive particle has more sharp, free-cutting edges. It cuts cooler because its resistance to dulling lessens frictional drag. Use these new wheels on your tool grinding jobs — and see the surprising difference in their grinding action. Write for illustrated Catalog Bulletin ESA-272.

Cooler cutting
Faster grinding
Longer life
Better finish



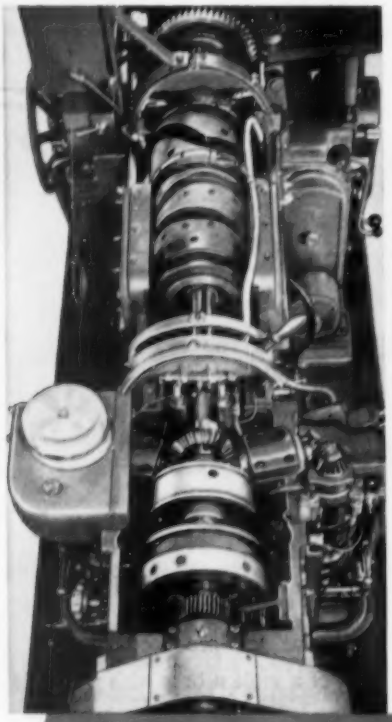
SIMONDS ABRASIVE CO.

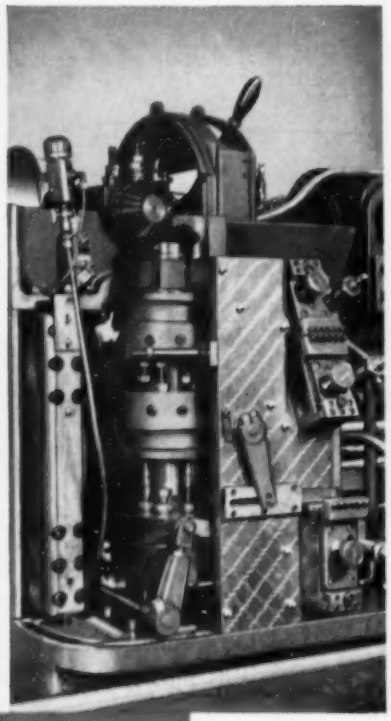
SIMONDS ABRASIVE COMPANY

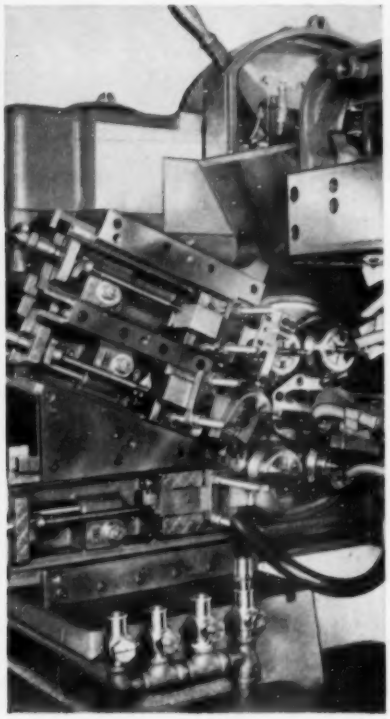
Tacony & Fraley Sts., Philadelphia 37, Pa.

DIVISION OF SIMONDS SAW AND STEEL CO.

BRANCHES: PHILADELPHIA, CHICAGO, DETROIT, LOS ANGELES, SAN FRANCISCO, PORTLAND, ORE.





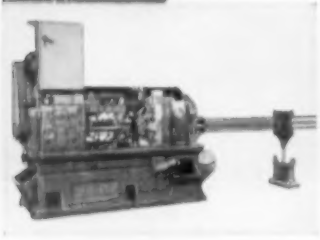


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1⅝" Sixes, and the 2⅝", 3½", 5", and 5¼" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

You buy near-perfection when you specify this Jessop steel

If you visit the Jessop Specialties Division, you'll be immediately impressed with the clean, quiet lab-like atmosphere, the intensity of effort and care that personifies true craftsmanship. For here Jessop processes fine *Truform* oil or *Windsor* air hardening tool steel into one of its top products . . . precision ground flat stock used for the production of highly accurate dies, gages, cutters, machine parts, straight edges or the like. This Jessop product comes as close to perfection as the steelmaker's art logically allows. Each piece, of any size, is highly-finished, dead flat and square, and guaranteed to have a thickness tolerance of plus or minus .001 and a width tolerance of plus .005, minus .000. An inspector double checks the analysis with a delicate Magnetic Analysis Production Comparator and a Profilometer is used for inspection of the finish. After all tests are passed, the stock is carefully wrapped for shipment to Jessop customers all over the world. If you have any application for this type of product, it will pay you to send in an inquiry. Jessop's pride of accomplishment will make it a better buy for you.

JESSOP

STEEL COMPANY • WASHINGTON, PA.

OFFICES IN PRINCIPAL CITIES

Jessop Steel of Canada Limited, Wallaceburg, Toronto

Jessop Steel International Corp., Chrysler Building, New York, New York

A Multipress case study

MULTIPRESS® ends rejects of plastic toy assemblies for Lionel

ASSEMBLING plastic and powdered metal toys with mechanical presses resulted in excessive scrap losses at Lionel Corporation. Then Multipress tackled the job, and rejects were a forgotten profit-taker.

With Denison's hydraulic Multipress, the ram stroke adapts itself automatically to variations in material thickness, delivers only the exact pressures required. No more loose assemblies because of inadequate ram pressure; no more fractured parts caused by excessive pressure.

Lionel also found that workers prefer the quiet, safe hydraulic operation of the Multipress . . . and lost time in tooling changes and maintenance has been cut to a minimum.

Let a Multipress expert show you how to improve your production methods . . . cut costs. Write Denison Engineering Division, American Brake Shoe Co., 1182 Dublin Road, Columbus 16, Ohio.

Rejects have been cut to a minimum by using Multipress for staking these miniature assemblies at Lionel Corp.

DENISON Hydr OIL ics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

Miller

FLUID PRESSURE

CTW

Continental Counterbores may be purchased individually or in sets. Selection of three sets available.

After the heaviest cuts—they disengage with a twist of the wrist

Continental Counterbores are designed so that cutting torque produces compression rather than shearing stresses. This counterbore never binds—you get quick, easy disengagement after all cutting operations. Anti-wedging action saves time and tools.

Continental Counterbores have double driving lugs on the cutters which engage double abutments in the holders, making a single powerful tool out of the cutter and holder. Double bearings, one above and one below the lugs and close to the cutting edge, guarantee rigid alignment of holder and cutter.

For more information or literature on Continental Counterbores, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit.

Continental **TOOL WORKS**

DIVISION OF

EX-CELL-O CORPORATION • DETROIT 32, MICHIGAN

56-61

Miller

FLUID PRESSURE BOOSTERS

BOOST 80 PSI AIR

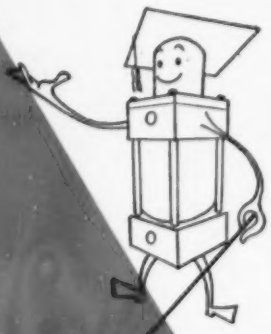
Input Range: 40 to 3000 psi Air or Fluid

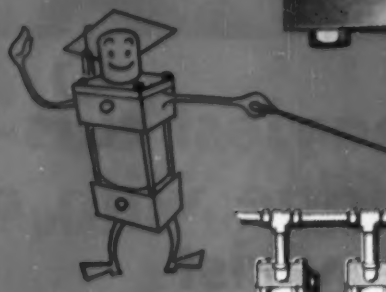
TO 2000 PSI HYDRAULIC PRESSURE

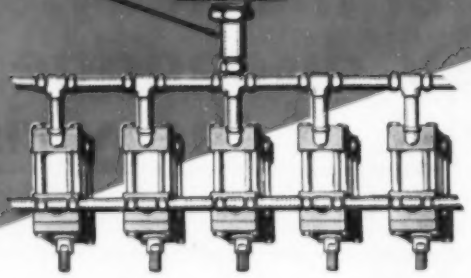
Output Range: 200 to 10,000 psi Fluid

- Save space, weight and investment cost by replacing pump installations in many applications.
- Less costly to install, operate and maintain.
- **Hold Pressure indefinitely** without the motion and heat generation of ordinary pump circuits.
- Provide—at point of cylinder thrust—more efficient power with less weight in less space than direct driven air cylinders
- Save up to 95% of air consumed by direct driven air cylinders
- Operate at speeds of 30 to 450 strokes per minute.

NOTE: In addition to its most complete line of "Custom-Built" Boosters available on normal delivery Miller offers 5" bore, 25 to 1 ratio, boosters for immediate delivery in either 6" or 12" stroke. Write for data and prices.



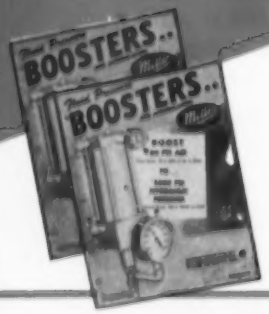




ESPECIALLY RECOMMENDED FOR

- **WELDING**
- **PUNCHING**
- **SHEARING**
- **CLAMPING**
- **RIVETING**
- **CRIMPING**
- **PRESSING**

and similar applications



FULL DETAILS IN MILLER BULLETIN B-200 SENT FREE ON REQUEST
Other Miller products include: Air cylinders, 1½" to 20" Bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

Miller

MILLER FLUID POWER DIVISION

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

structurally homogeneous

PARKER-KALON stress relieved socket screws

After controlled heating and equally controlled uniform quenching imparting maximum strength, P-K Socket Screws are carefully tempered to assure ductility, proper elongation and high impact strength. This is your assurance that . . . *If it's P-K . . . It's O-K!*

PARKER-KALON DIVISION, General American Transportation Corporation • Manufacturers of Socket Screws, Self-tapping Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws.

Sold Everywhere Through Leading Industrial Distributors — Factory: Clifton, New Jersey • Warehouses: Chicago, Illinois; Los Angeles, California

PARKER-KALON® fasteners

"FORGING PUNCH PRODUCTION INCREASED 600%"

"Our Clausing hydraulic tracer enabled us to increase production of forging punches 600%, and it has saved time on several other jobs as well. It sure paid for itself in short order."

HARVEY D. ROBEY CO.
E. LANSING, MICHIGAN

NEW CLAUSING 12" HYDRAULIC TRACER LATHES

provide automatic duplicating of multiple diameters, tapers, bevels, radii, grooves, chamfers.

The new Clausing 12" Hydraulic Tracer Lathe provides automatic reproduction, reducing to hours jobs that would otherwise require weeks or days. With this new CLAUSING you can . . . do automatic reproduction of intricate patterns • eliminate repetitive measurements, multiple tool set-ups, expensive forming tools • impart a smooth, stepless finish • provide automatic sizing • reduce chance for human error • practically eliminate scrap.

FOR SHORT RUN AS WELL AS VOLUME PRODUCTION — short runs can be done economically because set-up and tool changes can be made in minutes. Savings on long runs are phenomenal.

HANDLES WORK up to 2½" diameter differential, 18" length. Hydraulic cylinder housed in Servo motor provides power to firmly drive and hold cutting tool. Slide feed, in and out, infinitely variable from 0 to 15" per minute. All critical parts of tracer unit hardened, ground and machine lapped.

FLAME HARDENED WAYS — VARIABLE SPEED DRIVE

Bed ways of lathe are flame hardened, ground. Variable speed drive from 43 to 222 and 250 to 1300 RPM, adjustable while running. Completely enclosed head stock, quick-change box, apron . . . oil bath lubrication. Spindle turns on big Timken "Zero-Precision" tapered roller bearings.

write **FOR FREE LITERATURE**

Atlas CLAUSING — PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY

CLAUSING DIVISION ATLAS PRESS COMPANY

4-114 N. PITCHER ST., KALAMAZOO, MICHIGAN

MACKLIN CO., JACKSON, MICH. U.S.A.
Protect your Production
SEE SAFETY GUARDS - SEE AMERICAN STANDARD SAFETY CODE
10425
SV- GC60 G12 V8
6 X 3/4 X 5/8
OPERATE NOT TO EXCEED
4136 RPM

PLAN
FOR TOMORROW'S PRODUCTION TODAY

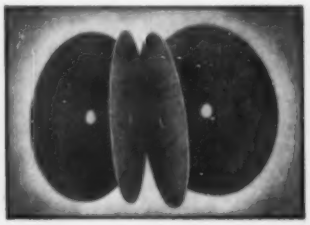
·····with MACKLIN "Wheels of PROFIT"

Today, the automated, high speed grinding of new and improved metals calls for higher quality grinding wheels than ever before. Wheels like the Macklin V-8 illustrated above. V-8 is setting new standards of performance in the grinding of cemented carbide tools. It cuts faster with less push, and it's easy on the tools. *Your* management will like V-8's long wheel life, and the way it cuts down operator fatigue.

But, *V-8 is only one of a complete line of* Macklin "Wheels of Profit" for industry. Every Macklin wheel is designed to meet the demands of today's production, is part of a program of constant product development and improvement . . . because planning for tomorrow's production today is our most important job.

YOUR NEAREST MACKLIN DISTRIBUTOR OR FIELD ENGINEER WILL BE GLAD TO DEMONSTRATE THE MACKLIN WHEEL WHICH IS BEST FOR YOUR PARTICULAR GRINDING PROBLEM. YOUR LETTER OR PHONE CALL WILL RECEIVE PROMPT ACTION.

MACKLIN company Dept. 32, Jackson, Michigan



Wheels for . . .

- Surface Grinding
- Cylindrical Grinding
- Centerless Grinding
- Tool Sharpening
- Wirebound Cylinder Wheels
- Foundry Wheels
- Segmental Wheels
- Cut-Off Wheels

BAY STATE

PRECISION PERFORMANCE...

To the parachutist, precision performance means rigid training, snap judgment, and nerves of steel.
To tap users, precision performance means production-line continuity, better threaded parts, increased tap life . . . and BAY STATE!

BAY STATE TAPS

Bay State Tap & Die Company

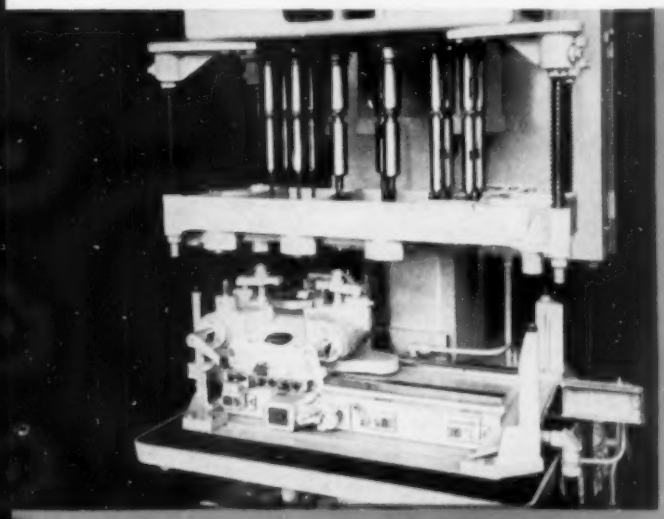
Mansfield, Massachusetts

On the shelves of your local Industrial Supply Distributor

Natco Naturals

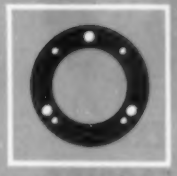
Cost-Cutting Ways
You Can Use
Standard Multi-Spindle Natcos

Any time your parts require machining *more than one hole*–drill, bore, face or tap–it may well be a "Natco Natural." Your standard Natco will produce substantial savings in a surprising number of situations, *even in small job-shop lots!* Call in your nearby Natco field engineer; he'll tell you in short order whether you've got a "Natco Natural" there.

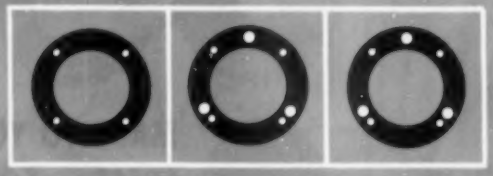


Multiple Drilling Operations on One Part-Face

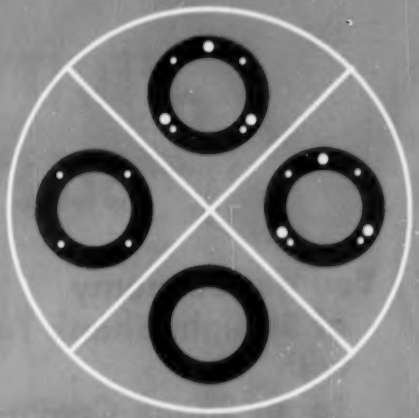
Straight-line indexing on a *Natco H6 produces 49 parts per hour. 4 holes drilled in first position, 3 holes drilled in second position, 4 holes c'bored in third position. One part completed every three strokes. Automatic cycling frees operator for other work. Illustrations below show three other ways of handling this part.*



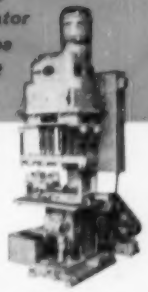
45 parts per hour. *Inexpensive box jig. Operator positions jig under appropriate spindles. One complete part for 3 strokes of machine.*



75 parts per hour. *3-position fixture. Operator shifts parts after each stroke. One part completed every stroke.*



155 parts per hour. *Rotary 4-position index table. Operator unloads and loads while three operations proceed. One part completed every stroke.*



Standard multi-spindle Natcos *range from 1 hp, 10-spindle machines to 25 hp machines with up to 72 spindles. Spindles in standard Natcos are driven through universal joints and located by either adjustable arms or bored slip plates.*

NATCO

National Automatic Tool Company, Inc.

Richmond, Indiana

Multi-spindle drilling, boring, facing & tapping machines. Special machines for automatic production.

Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.

"REMOVABLE" TAPER SHANKS for Small Tools

Cut Your Costs with these

Glenzer

UTILITY SLEEVES

You get economy of Straight Shank Tools with Taper Shank Convenience!

They supply removable taper shanks for number, letter, and fractional drill sizes, and other small tools — #1 thru #7 Morse tapers, #7 thru #13 Brown & Sharpe Tapers, and A.S.A. .239, .299, .375, and 4½ tapers.

Standard in leading automobile and many other plants — large and not so large — since 1919.

Send for Circular Index A

THE J. C. GLENZER CO., Inc.
1552 E. NINE MILE ROAD, DETROIT 20, MICH.

USE READER SERVICE CARD; INDICATE A-4-252-1

You Can Rely on a ROUSSELLE

DEEP THROAT PRESS | HORN PRESS | O.B.I. PRESS | DOUBLE CRANK PRESS

THESE 40-TON PRESSES

take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are *very moderately priced.*

Significant savings may result if you let our engineering staff assist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers.

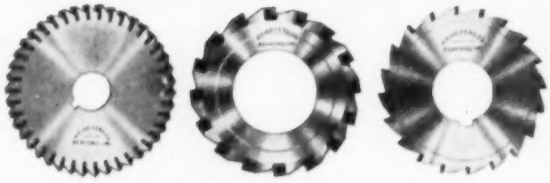
Choice of 25 models in 5 to 40-ton sizes.

Manufacturers of Rousselle Presses

SERVICE MACHINE CO.
2310 WEST 78th STREET
CHICAGO 20, ILL.

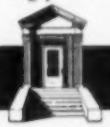
USE READER SERVICE CARD; INDICATE A-4-252-2

PRECISION CUTTERS!



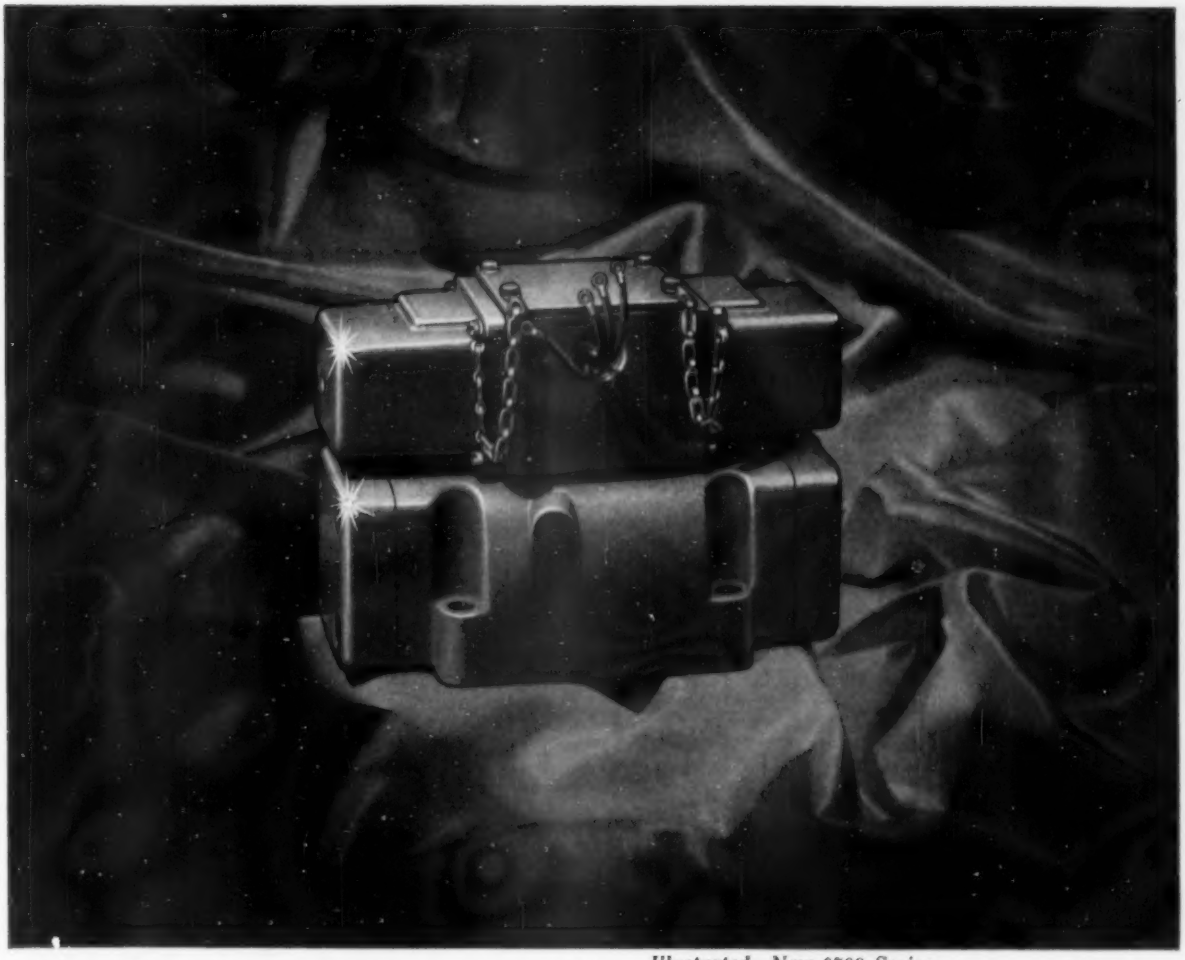
MADE TO YOUR EXACT SPECS . . . SOLID CARBIDE, OR CARBIDE TIPPED!

Why put up with stock cutters, when made-to-order cutters cost no more? Cutters designed for specific gang-milling, slotting, venting, slitting or grooving operations in various diameters and thickness to suit YOUR needs exactly. Fast service: all component materials carried in stock. Top-flight reputation for dependability built since 1888. Furnish complete specs, quantities desired and material to be cut when requesting prices. Write for Bulletin No. 52



W. F. MEYERS CO., INC., BEDFORD, INDIANA

USE READER SERVICE CARD; INDICATE A-4-252-3



Illustrated—New 9700 Series
Piggy Back Hydraulic Control Valve
Meets J.I.C. Standards

Look to Logan

the ultimate in hydraulic valve design

FREE SEND FOR THE "LOGAN CALCULATOR"
A gift to you from Logansport Machine Company upon request.

MEMBER: Natl. Mach. Tool Builders Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
839 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

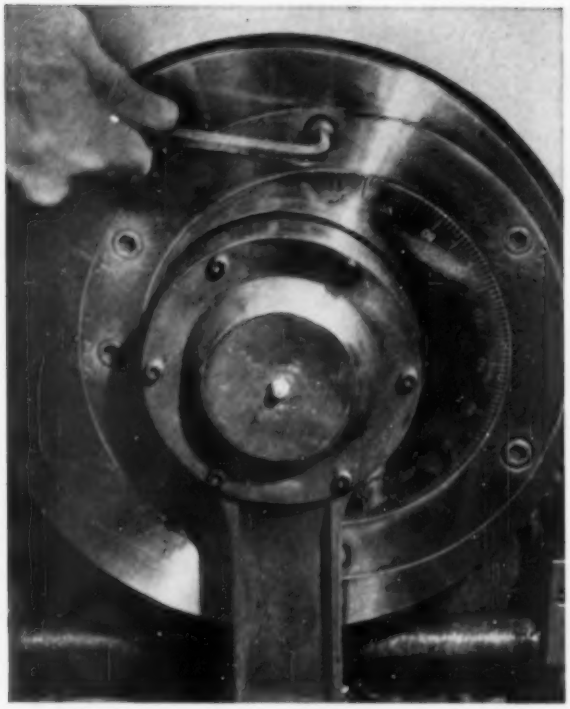
- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-5-1 ULTRAMATION CYLINDERS
- ☐ 51 PRESSES
- ☐ FACTS OF LIFE
- ☐ 62 SURE-FLOW PUMPS
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 and 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 70-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

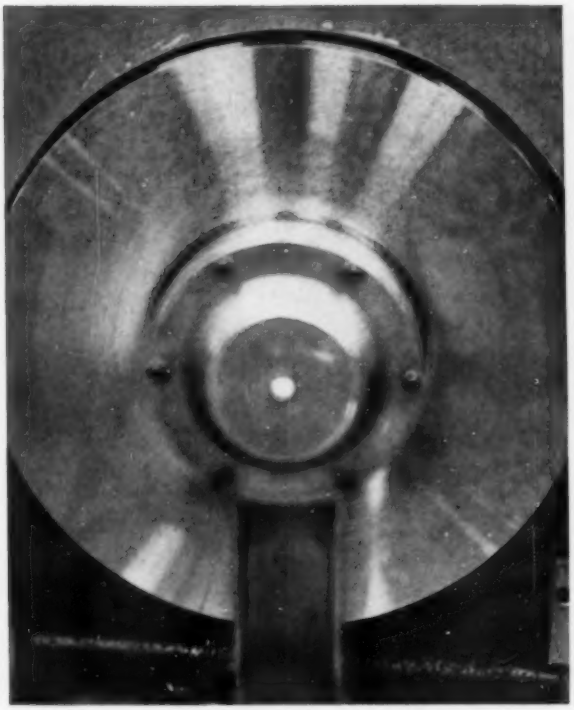
TO:

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

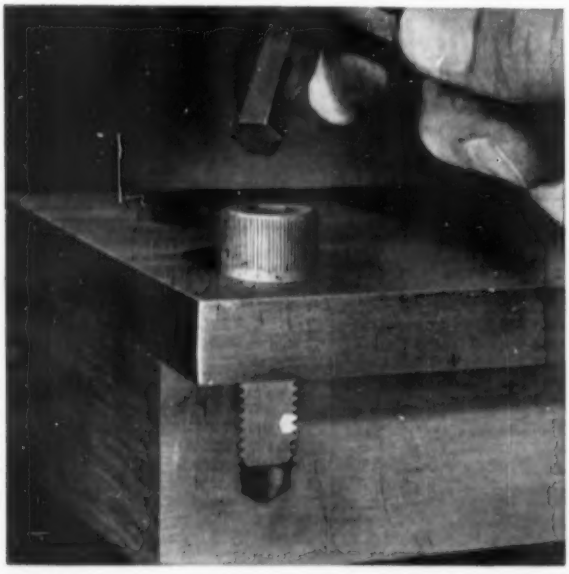




Self-locking UNBRAKO socket screws keep critical adjustments secure in the eccentric drive mechanism of this fatigue testing machine. Drive system delivers varying loads up to 15,000 pounds force to equipment under test at 1050 cycles per minute.

Vibration won't loosen Self-locking UNBRAKO socket cap screws

Screws with Nylok* device permit adjustments, keep precise settings during long test runs



HOW IT LOCKS. The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together, and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok self-locking device stay tight under constant vibration.

Take the eccentric drive system in the fatigue testing machine illustrated above, for example. This machine must frequently run for periods up to 2 weeks or longer, day and night, to complete a single test. Loosening of the screws which are used to adjust the tension-setting mechanism could not only cause damage to the machine, but also make the test data worthless. Self-locking UNBRAKO socket head cap screws eliminate such problems.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or pounding, or endless running of a machine, won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives complete catalog and technical data on the entire line of UNBRAKO socket screws with the Nylok self-locking device. Or see your authorized industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

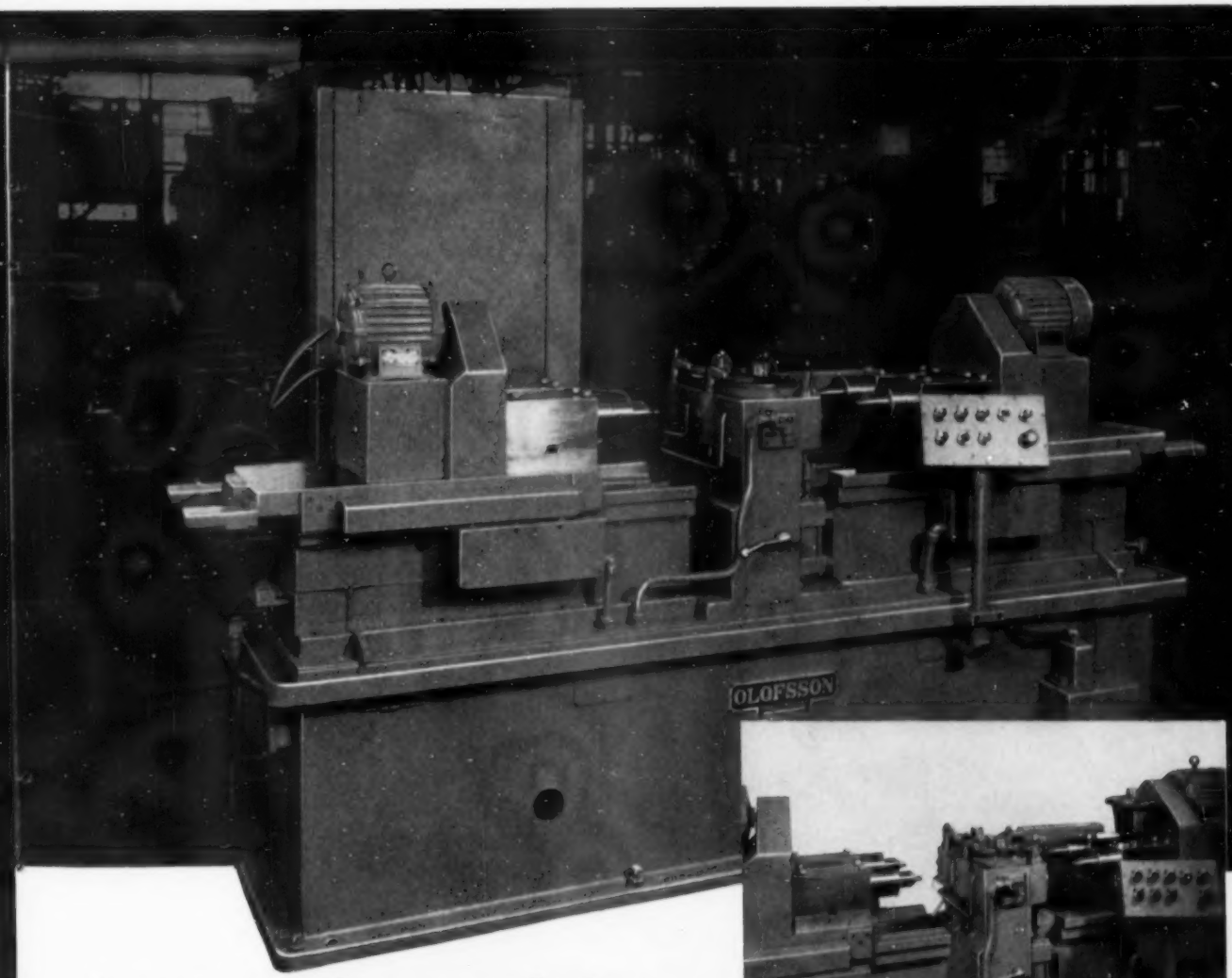
UNBRAKO SOCKET SCREW DIVISION

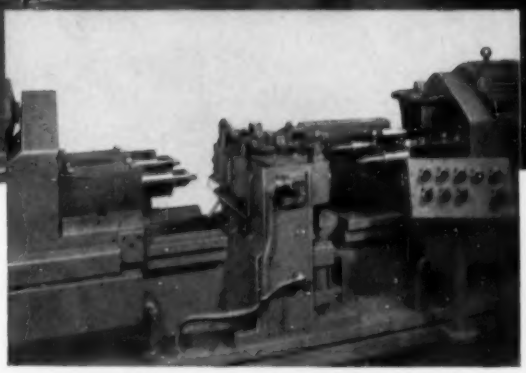
STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

*T.M. Reg. U.S. Pat. Off. The Nylok Corporation





Olofsson Two Station Precision Boring Machine arranged with Way Units. Conforms to J. I. C. electrical and hydraulic standards.

Is any part of your production COSTING TOO MUCH?

Today's competitive market demands constantly increasing production per man hour. Any machine tool which can't deliver that kind of production is too costly to operate. That's why an automotive manufacturer recently consulted with Olofsson engineers to increase production and lower unit costs on a boring operation. The result...

TYPE OF MACHINE—Olofsson Two Station Double End Precision Boring Machine arranged with Way Units.

WORK PERFORMED—Finish bore two holes, *in line,* simultaneously in cast iron differential cases.

RATE OF PRODUCTION—250 cases per hour.

MACHINE OPERATION—The operator loads the part into the nest and presses the clamp and start cycle button. Both units bore "in" simultaneously and rapid return to unload position. Hydraulically operated finger clamps release the part automatically when both units are in clear position. A manually operated elevator device is used to help insert and unload part from nest with ease.

Hand cycle provides additional retraction of spindles for setting or removal of cutting tools, also independent control of either unit.

Perhaps you have a tough production problem which can be solved efficiently and economically with Olofsson Special Machinery. You'll find it "pays to specialize with Olofsson".

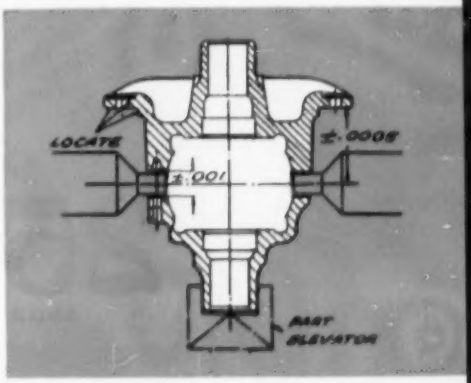


Diagram of differential case clamped into position for simultaneous, double-end precision boring operation.

Put the Olofsson Engineering Department to work for you. Write today. Or phone us at IVanhoe 4-5381, Lansing, Michigan.

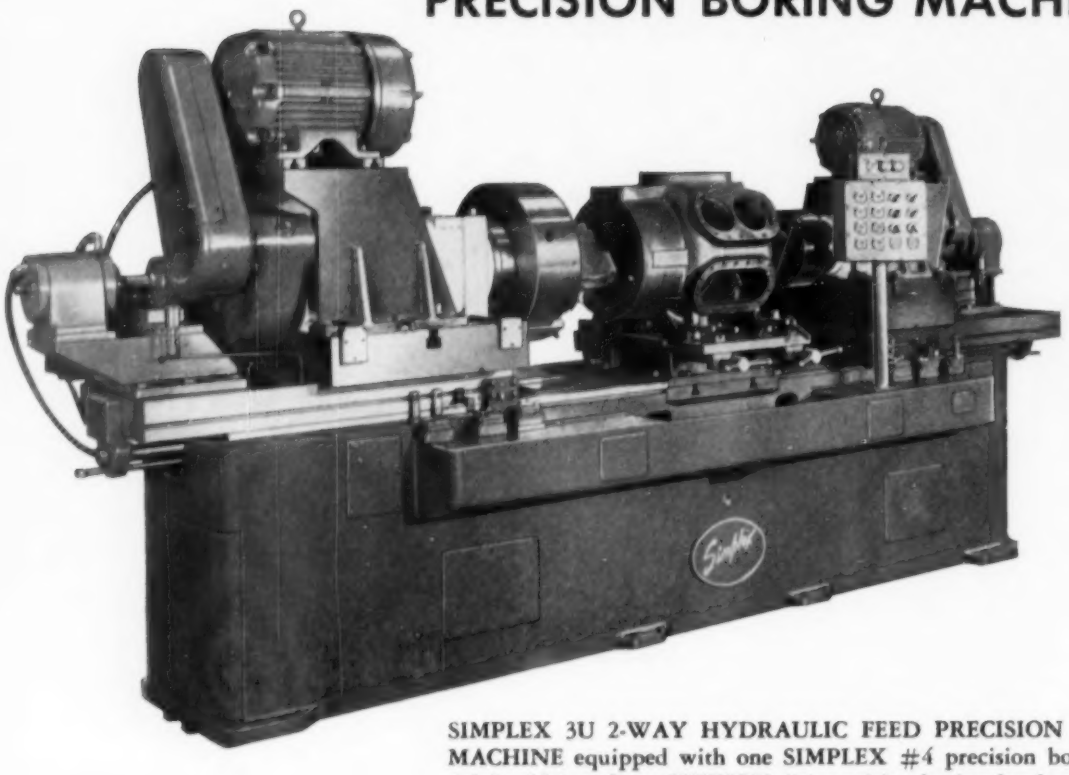
THE OLOFSSON CORPORATION

2731 Lyons Avenue · Lansing, Michigan

Manufacturers of Special and Automation Machinery and Precision Boring Machines

Simplex

PRECISION BORING MACHINES



SIMPLEX 3U 2-WAY HYDRAULIC FEED PRECISION BORING MACHINE equipped with one SIMPLEX #4 precision boring head (right side) and one SIMPLEX #5 precision boring head mounted on the left side. Each of the two sliding units supports, in addition to the boring heads, a drive unit, drive motor, and feed-out mechanism, one providing 3" of feed-out stroke and the other 1½". Two work holding fixtures, each designed to hold three sizes of Compressor Housings, were also furnished.

25TH YEAR

1932 – 1957

SIMPLEX MACHINE TOOL CORPORATION

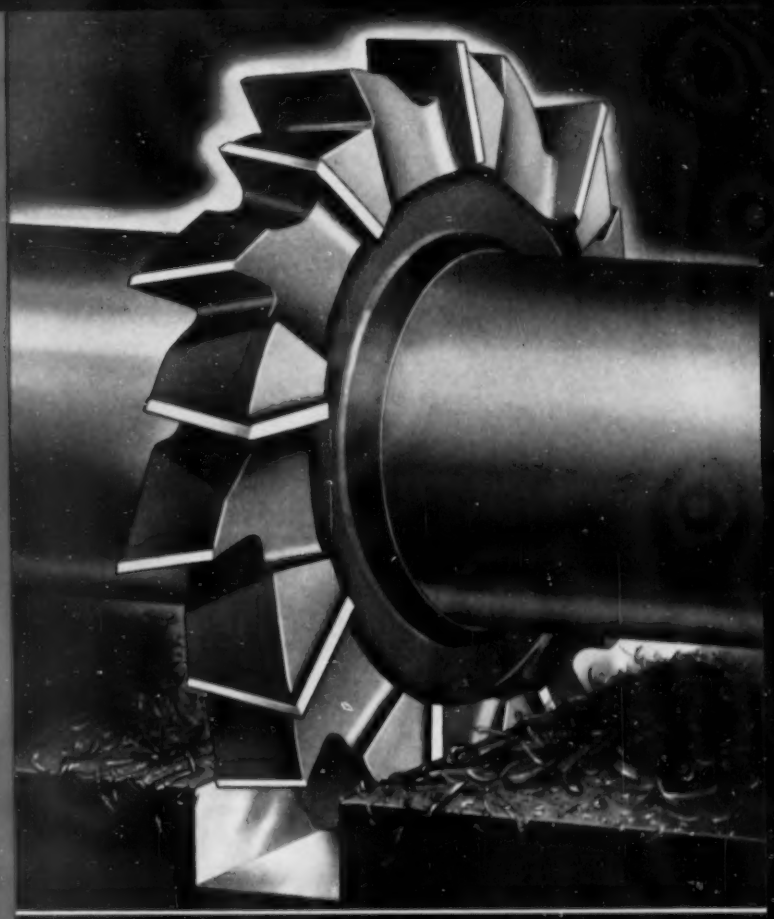
4528 WEST MITCHELL STREET

MILWAUKEE, WISCONSIN

PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES
SPECIAL DRILLING, TAPPING AND BORING MACHINES

Simplex

WHEN THE GOING GETS Rough



Complete line stocked by
the Standard Tool Distributor in your area

Proper selection of Milling Cutters from the *Complete Family* of "Standard" rotary metal cutting tools is the answer.

Modern metallurgy, sound engineering and fine craftsmanship have been built into these outstanding tools.

For low cost, high quality milling specify "Standard" Milling Cutters.

Quality Tools Since 1881

STANDARD TOOL CO.

3950 CHESTER AVENUE CLEVELAND 14, OHIO

STANDARD TOOL CO.

FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Carbide Tools · Gages*

Pangborn Hydro-Finish cut cleaning time 50% in this plant
Paid for itself in only six months

Pangborn Hydro-Finish really paid off for this leading glass manufacturer. Cleaning quality increased moldlife 10% to 15% and total cleaning and polishing time was cut in half! The resultant savings paid for the machine in six months and represented a substantial weekly sum thereafter.

USE PANGBORN HYDRO-FINISH FOR:

Deburring • Surface finishing • Finishing threaded sections • Improving cutting tool life • Maintaining dies and molds • Removing grinding lines • Removing heat treat scale • Preparing surfaces

Today, through new design and use of air jet sluriators, Pangborn Hydro-Finish costs less originally, costs less to maintain and gives you easier handling and added efficiency. Write for Bulletin **1403** to PANGBORN CORP., **4700** Pangborn Blvd., Hagerstown, Md.

Pangborn
BLAST CLEANS CHEAPER

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-258-1

It's NEW! **3000 SERIES BURR-RITE *Sr.***

NEW MACHINE NEW MEDIA Reduce Your Deburring Costs

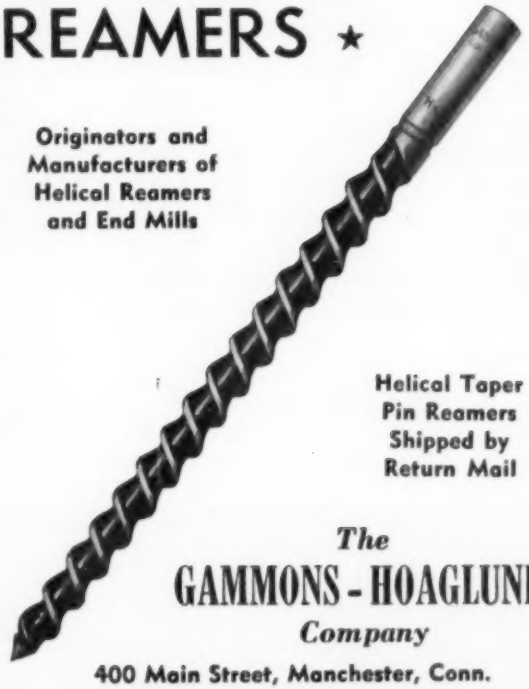
● Is DEBURRING required on your products? Do you realize the savings that can be made by the Barrel Finishing process? Write us today and get full details about this new, improved machine. SEE its value on your parts . . . Send samples for free processing today.

Globe Div. CASALBI CO.
550 Wayne St., Jackson, Michigan
Barrel Finishing Equipment • Media • Compounds

USE READER SERVICE CARD; INDICATE A-4-258-2

GAMMONS REAMERS ★

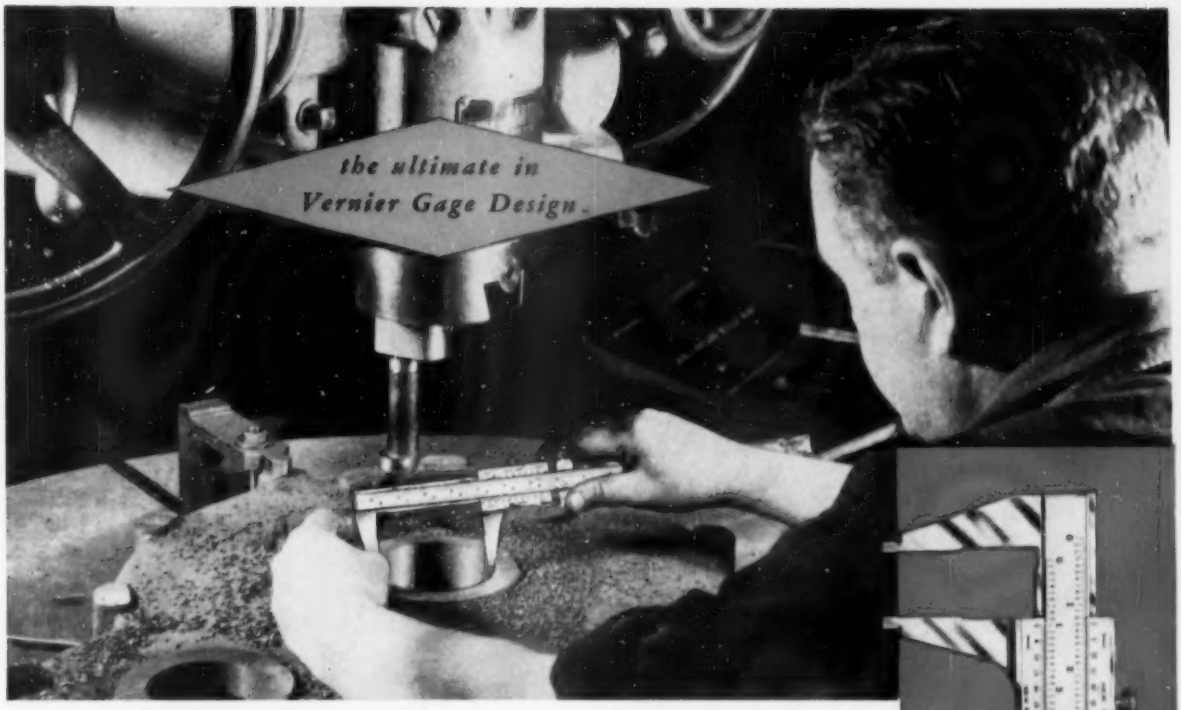
Originators and Manufacturers of Helical Reamers and End Mills



Helical Taper Pin Reamers Shipped by Return Mail

The* GAMMONS - HOAGLUND *Company
400 Main Street, Manchester, Conn.

USE READER SERVICE CARD; INDICATE A-4-258-3



New Starrett® No. 123 *Satin Chrome*
MASTER-VERNIER CALIPER

Here is a new Vernier caliper that can be used with supreme confidence in its master precision . . . a gage with Starrett no-glare *Satin Chrome Finish* for easy reading and rust and stain resistance . . . with new, long 50-division Vernier scales for simplified setting and error-proof reading without a magnifying glass . . . with new flush fitting Vernier scales to eliminate parallax errors . . . with new open-face design which provides both inside and outside Vernier scales on the same side of the tool — you hold and read it exactly the same for all measurements.

If you take pride in the precision standards of your shop, you'll want the new Starrett No. 123 MASTER-VERNIER Caliper . . . for its positive precision, error-proof design and lifetime accuracy.

Your Industrial Supply Distributor will gladly demonstrate its many outstanding new features . . . or send for descriptive folder.

NO OTHER VERNIER GAGE GIVES YOU ALL THESE STARRETT FEATURES

SATIN CHROME FINISH — no-glare, easy reading, long wearing, rust and stain resisting.

NEW LONG VERNIERS with widely spaced graduations for easy setting and reading.

FLUSH FITTING VERNIER PLATES to eliminate optical reading errors.

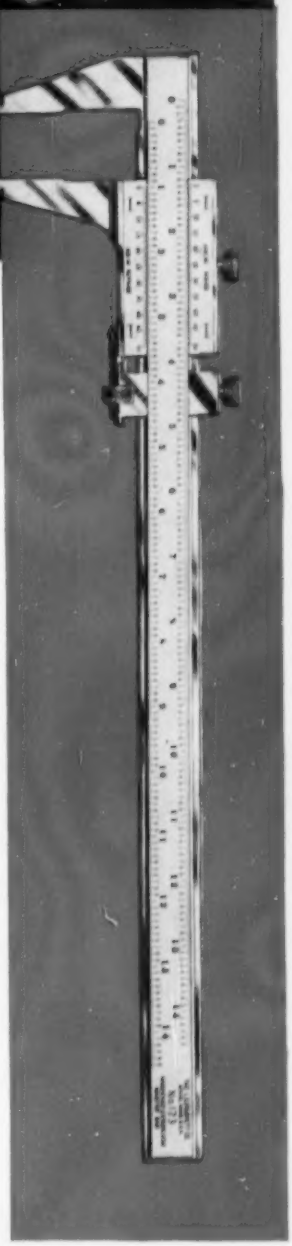
OPEN-FACE DESIGN with inside and outside scales on the same side — no need to turn the tool.

HARDENED, STABILIZED master bar for maximum rigidity, resistance to wear, lasting accuracy.

EXTRA LONG ADJUSTING JAW for greater bearing surface to assure perfect squareness.

NEW JAW DESIGN for greater rigidity and resistance to springing.

12- AND 24-INCH SIZES graduated in thousandths to read the full 12- or 24-inch length.



BIG NEW CATALOG NO. 27

Describes and illustrates the complete Starrett line. Ask your Industrial Supply Distributor or write for free copy. Address Dept. E, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

Starrett®

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

WIDE MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

How much are you paying for the machine that isn't there?

If you are machining this part, or one like it, you may be paying 49 cents more on every dollar—*in material alone*—than you need to pay.

For 49% less material was used by making it on a Torrington Rotary Swaging Machine, which reduces metal instead of cutting it away. A smaller rod was grooved, and a washer was swaged into the groove. Production jumped from 80 to 260 pieces an hour—with unskilled labor!

You can put many operations on a Torrington Swager—pointing, tapering, reducing, sizing, forming inside contours and threads. With savings like these, your swager will shortly pay for itself.

See for yourself what swaging is and what it can do. Let us show you our new, 20-minute, full-color film on swaging. And write for our new catalog on Torrington Rotary Swaging Machines.

THE TORRINGTON COMPANY
Swaging Machine Division
444 North Street, Torrington, Conn.

TORRINGTON ROTARY SWAGING MACHINES

IMPORTANT: For your convenience this sheet is perforated. Tear it out and "buck-slip" it to the proper man in your plant.

For long-lasting, razor-sharp edges on cemented carbide tools, use the wheel engineered for the job — Resinoid Bond Diamond Wheels by Carborundum. See complete technical data on the back of the page.

Ask the man from **CARBORUNDUM** REGISTERED TRADE MARK **BONDED ABRASIVES DIVISION**

Also makers of a complete line of Coated Abrasives and Abrasive Grain

ATTENTION TOOL ROOM FOREMAN: Turn the page and see the Product Performance Record written especially for you.

PRINTED IN U.S.A. 7M9

Product Performance Report

DIAMOND WHEELS FOR CEMENTED CARBIDES

Operation	Grind clearance angle on a multi tooth carbide tipped milling cutter.
Project	Select a wheel to grind the cutter to size and produce a fine finish at a fast production rate.
Results	BR 7 resinoid bond diamond wheel ground a 24 tooth cutter with ⅜" x ¾" inserts in one pass and maintained size to a maximum run out of .0002". One additional spark out pass produced a finish of 10 M. I. that was free from check and discoloration.
Note	Carborundum, leader in abrasive techniques, backs up its products with trained sales representatives, a staff of competent field engineers and an abrasive engineering laboratory... all available to you to put more sense in your abrasive dollar.

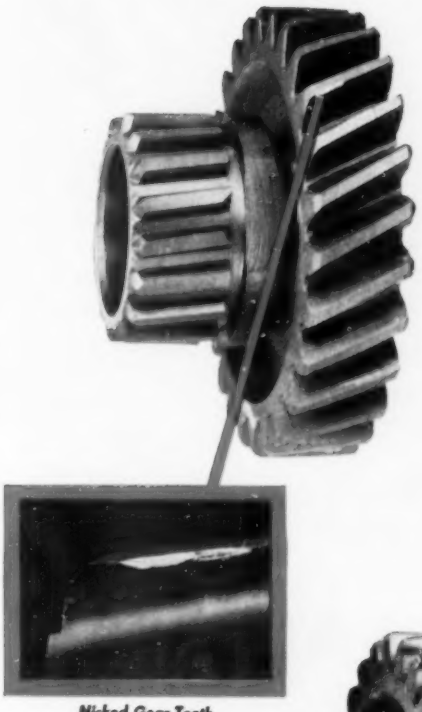
Here is another in the series of Product Performance Reports being released by the Bonded Abrasives Division of The Carborundum Company. A color photograph of this actual operation is shown on the back of this page.

• *Ask your local distributor... or the man from*

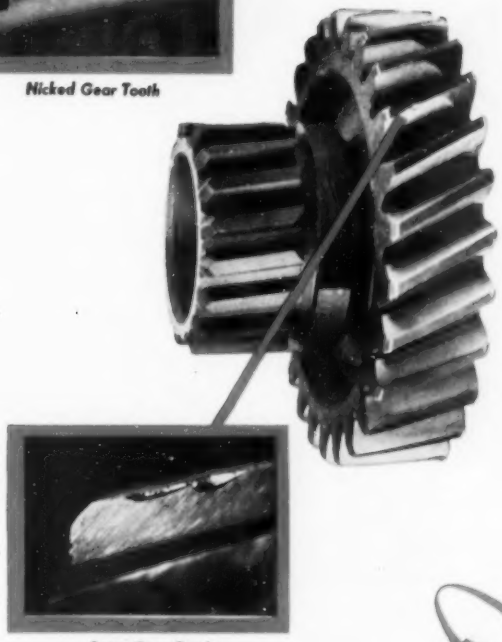
CARBORUNDUM
REGISTERED TRADE MARK

PRINTED IN U.S.A.

RED RING
HARD GEAR HONING
PRODUCES QUIET GEARS



Nicked Gear Tooth



Same Gear Tooth After Honing

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Patents pending

7631

OSBORN BRUSHING METHODS *worthy of your confidence*

BEFORE BRUSHING

AFTER BRUSHING

Centerless Brushing Method

quickly produces precision finish

Osborn Matic® Brush puts final finish on aluminum pistons.

WHEN it comes to precision finishing of cylindrical parts, Osborn's Centerless Brushing method does the job quickly and efficiently.

The aluminum pistons shown above are fed across the face of an Osborn Matic® Bufcut® Brush mounted on a standard centerless grinder. Feather burrs are thoroughly removed, surface junctures blended, and surface finish refined . . . automatically and economically.

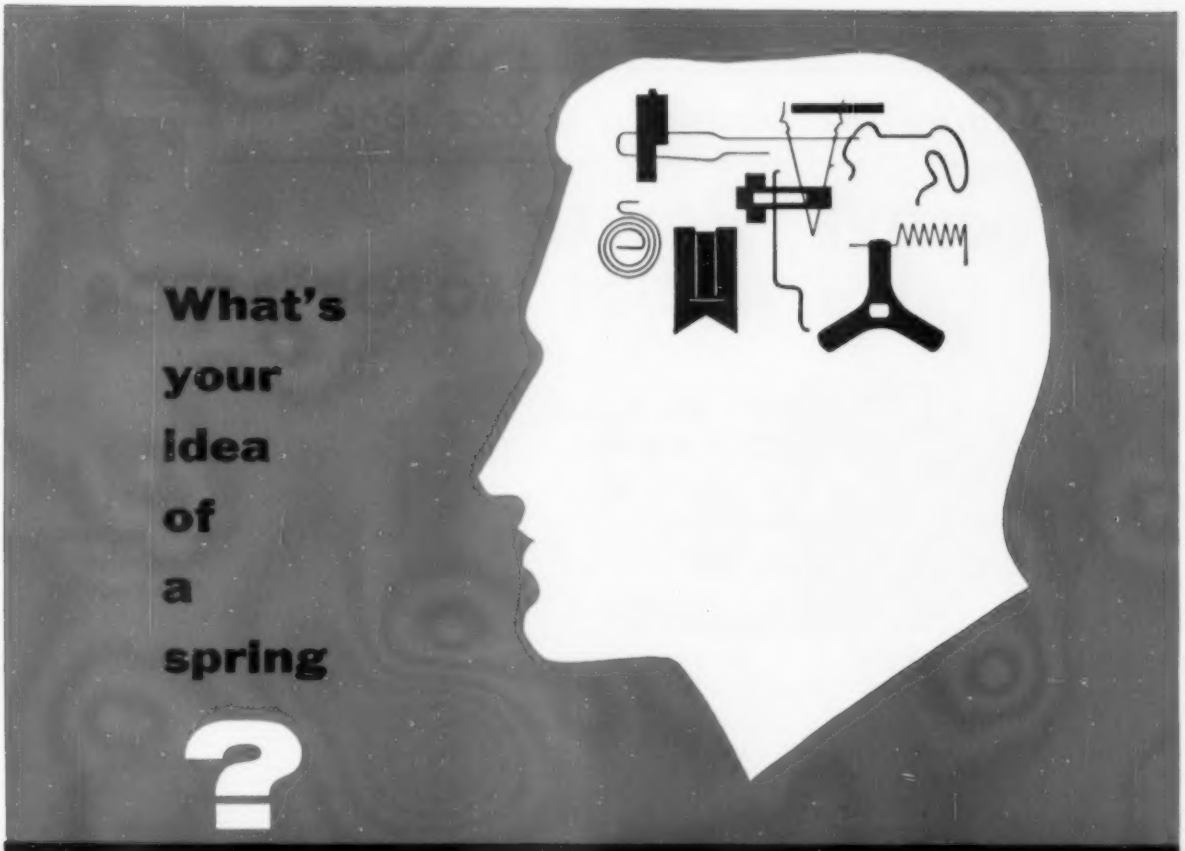
A wide range of cylindrical parts can be processed in a similar manner.

An **O**sborn **B**rushing **A**nalysis, made in your plant at no obligation, will demonstrate how Osborn Power Brushing Methods can help automate your operations...improve your product. *The Osborn Manufacturing Company, Dept. K-33, Cleveland 14, Ohio.*

Write Today for the new 100-page Osborn Catalog 210-C.

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES



If you have a coiled or flat spring in mind, let us help you get it down on paper – and into production. Years of specialized experience are at your service. Write for free booklet "Spring Design and Selection – in brief."

WALLACE BARNES COMPANY
BRISTOL, CONNECTICUT

THE WILLIAM D. GIBSON COMPANY
1800 CLYBOURN AVE.
CHICAGO 14.

RAYMOND Manufacturing COMPANY
CORRY, PENNSYLVANIA

BARNES-GIBSON-RAYMOND
40300 PLYMOUTH RD.
PLYMOUTH, MICH.

B-G-R COOK PLANT
ANN ARBOR MICHIGAN

DIVISIONS OF ASSOCIATED SPRING CORPORATION
COAST TO COAST

SEABOARD Pacific Div.
15001 S. BROADWAY
GARDENA, CALIF.

OHIO DIVISION
1825 EAST FIRST ST.
DAYTON, OHIO

WALLACE BARNES COMPANY
STATE FAIR BLVD.
SYRACUSE 9, Serves N.Y.

MILWAUKEE DIVISION
341 E. ERIE ST.
MILWAUKEE, WIS.

DUNBAR BROTHERS COMPANY
BRISTOL, CONN.

F. H. MAHROSS AND SONS CO.
BRISTOL, CONNECTICUT

THE WALLACE BARNES CO., LTD.
HAMILTON CANADA

8720
© 1957 A.S.C.

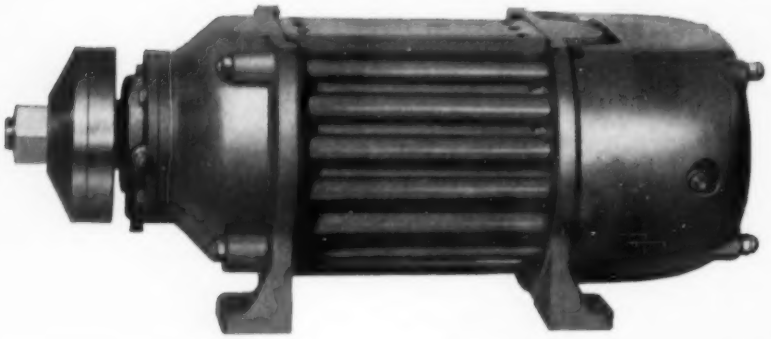
Divisions of

ASSOCIATED SPRING CORPORATION

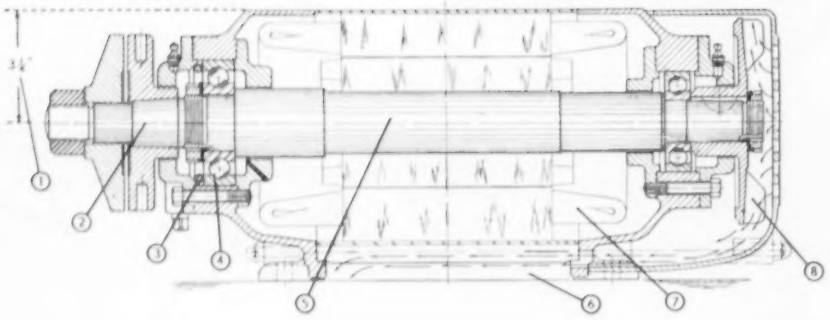
GENERAL OFFICES: BRISTOL, CONNECTICUT

Serving the Industry Since 1852

POSITIVE POWER
with a WOODS MOTOR ARBOR



TYPE L
Totally-Enclosed
Fan-Cooled
Dust-Proof



Full Tape Insulation

Outstanding Features of WOODS Precision Motor Arbors—1 HP to 30 HP (2 and 3 phase)

1. 3¼ inches, centerline to flatted top or either side, up to 7½ horse-power.
2. Taper mounted saw-flange insures accuracy of face and is readily demountable for bearing inspection.
3. End-play of arbor prevented by annular spring-ring.
4. Abnormally large ball-bearings with ample lubrication for operation for extended periods without attention.
5. Shaft of extreme rigidity for stability and smoothness of operation.
6. Cooling air is directed over the OUTSIDE surfaces. No pockets to collect dust and restrict radiation.
7. Electrical design of a high order with high pull-out torque for heavy cuts.
8. Cast fan, securely driven by key and lock-nut.

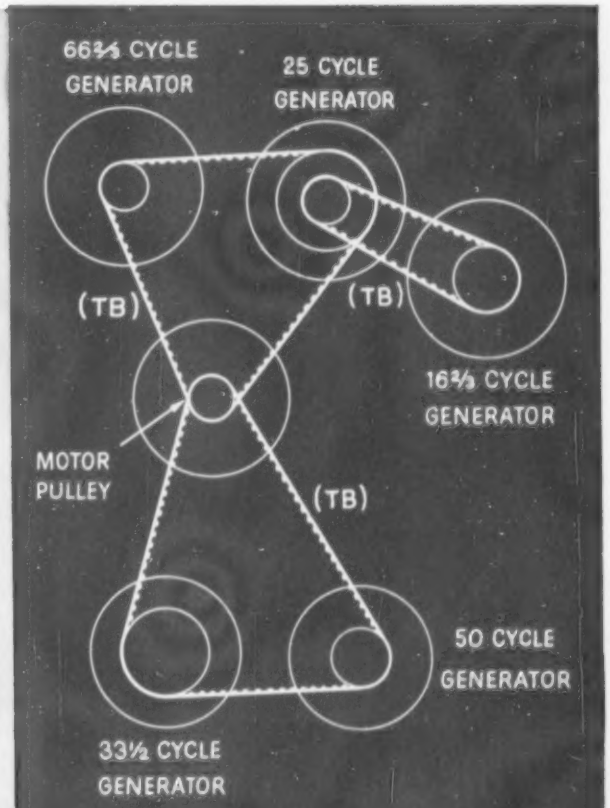
Cut Operating and Maintenance Costs by Speeding the Work and Eliminating Loss of Production and Expensive Repairs of Belt-Driven Arbors. Write today for Descriptive Material.

MOTOR DIVISION

S. A. WOODS MACHINE CO.
27 DAMRELL STREET
BOSTON 27, MASS.

PowerGrip "TIMING" BELTS

Making one motor do the job of five



Above is a schematic drawing of a 5-frequency telephone ringing unit on a party-line system. Previously, five motors were needed to generate the different ringing frequencies. But with the installation of just *three* U.S. PowerGrip "Timing" Belts (TB) *only one motor is needed* now. That's because U.S. PowerGrip provides a positive, non-slip grip that preserves the exact speed ratios and the synchronization needed to maintain critical frequencies. And there is absolutely no measurable power loss.

This is one more example of the U.S. PowerGrip "Timing"® Belt's ability to simplify and improve a power transmission unit . . . one of the reasons why the invention of U.S. PowerGrip "Timing" Belt was recently awarded the Franklin Institute's Edward Longstreth Medal for "Invention of High Order."

Whether it's for the design of hand tools, lathes, drill presses, saws, electric typewriters – from fleapower to horsepower – U.S. PowerGrip offers all these advantages:

- *no slippage, no take-up – allows short centers, high ratios.*
- *absence of metal-to-metal contact – eliminates need for lubrication and housing devices.*
- *handles speeds up to 16,000 F.P.M. or so slow as to be imperceptible to the eye.*
- *close to 100% efficiency.*
- *imbedded with steel cables for high tensile strength*
- *constant angular velocity.*

These belts – plus expert engineering service – are obtainable at "U.S." power transmission distributors, at any of the 28 "U.S." District Offices, or by writing us at Rockefeller Center, New York 20, N. Y.

Mechanical Goods Division

United States Rubber

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-267

BRISTOL socket screws help Army NIKE blast off

We're proud that Bristol Multiple-Spline socket screws were selected for use in the NIKE, *first truly operational U. S. guided missile.*

First, because NIKE and its complex guidance equipment are so important to our national defense.

Second, because we know that these Bristol Multiple-Spline socket screws met the most exacting requirements for holding power against shock and vibration. The Bristol-originated Multiple-Spline socket allows these screws to be wrenched up exceptionally tight without danger of stripping the socket.

Bristol Multiple-Spline socket screws, both set and cap, are ideal for critical applications in a host of products, in addition to missiles and guidance equipment: communications equipment of all types, shavers, instruments, vending machines, cameras, desk calculators—wherever ability to take extra wrenching torque is a factor.

Find out about them from your industrial distributor today.

A-6.36

Precision socket screw manufacturers since 1913

Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap Screws up to 1½".

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

USE READER SERVICE CARD; INDICATE A-4-268-1

AIR-MITE

HIGH PRODUCTION AIR PRESS *with more Quality Features*

★ Solid Steel Column. Greater strength and rigidity.

★ Brass cylinder, aluminum end castings, Hy-Car piston cups.

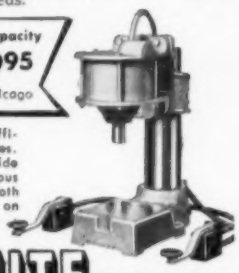
★ Accurately ground table.

★ Fast set-up and stroke adjustment.

You don't have to "baby" an AIR-MITE Press because they're ruggedly built to stand the gaff of production work. From the tip of their solid steel column to the heavy base, they're every inch a workhorse tool. Feature-for-feature, you can't buy a better, more economical operating press than an AIR-MITE.

Special adaptations available. Write us your needs.

1 Ton Capacity
$89.95
F.O.B. Chicago



New 3 Way Control Valve. For safer, more efficient press work, use AIR-MITE Control Valves. Connected in parallel and positioned on either side of an air press, they provide a safe, instantaneous press operating control. Operator must depress both handles to actuate press . . . keeps attention on work-piece, hands out of the way. For pressures up to 160 p.s.i.

AIR-MITE Devices, Inc.

4407 W. KINZIE ST., CHICAGO, ILLINOIS

USE READER SERVICE CARD; INDICATE A-4-268-2

Controlled Grinding of Tap Flutes and Chamfers

To Cut Your Tapping Costs, GRIND and RE-GRIND YOUR TAPS ACCURATELY!

Use these basic hook angles as a starting point for better tapping.

Aluminum	18°	Cast Iron	5°	Brass	5°
Copper	18°	Magnesium	18°	Plastics	8°
Mild Steel	8°	Stainless Steel	12°		

Write for specific details on how the BLAKE Flute and Chamfer Grinders give you the accuracy you need for low tapping costs.

EDWARD BLAKE COMPANY INC.
450 CHERRY ST., WEST NEWTON 65, MASS.

USE READER SERVICE CARD; INDICATE A-4-268-3

ALEXANDER DIE-SINKERS *for 2 or 3 dimensional work*

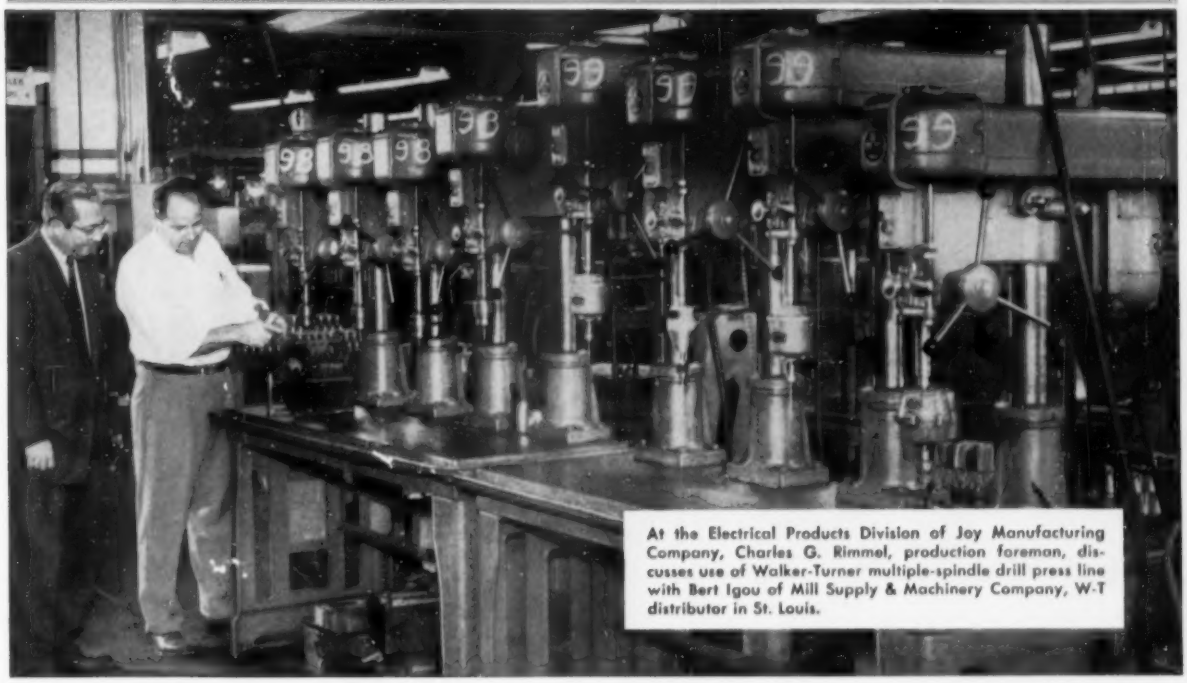
Latest model, No. 3A for molds and dies up to 1000 lbs. Ratios from 1.5:1 to 10:1, 14 spindle speeds from 475 to 9500 rpm, cutters up to ⅜" dia. Two smaller sizes, 1A and 2A.

Get a close look at Alexander engravers, die-sinkers, and cutter grinders—optical dividing head, centering and cutter grinder microscopes, cylinder roller attachments and other accessories. Write for catalog D on these quality, British machines.

J. ARTHUR DEAKIN & SON
150-28 HILLSIDE AVE.
JAMAICA 32, N.Y.

USE READER SERVICE CARD; INDICATE A-4-268-4

INDUSTRY REPORTS ON W-T WALKER-TURNER



At the Electrical Products Division of Joy Manufacturing Company, Charles G. Rimmel, production foreman, discusses use of Walker-Turner multiple-spindle drill press line with Bert Igou of Mill Supply & Machinery Company, W-T distributor in St. Louis.

The Electrical Products Division of

Joy Manufacturing Co. reduces machining costs by using W-T Drill Presses in place of larger, expensive equipment

Operator end-drilling contacts at Joy St. Louis plant with 20" Walker-Turner drill press. Output per shift averages 2,400 to 2,500 contacts per spindle.

The Electrical Products Division of Joy Manufacturing Company, St. Louis, Mo., manufacturers of electrical connectors, purchased one Walker-Turner 20" drill press several years ago. Results were so satisfactory that the company now has 15 units—13 on the production line and 2 in the toolroom.

Of particular note is the company's use of two Walker-Turner four-spindle drill presses (as shown above) for end-drilling and chamfering contacts. Now this work is being done faster and at less cost than with the larger, expensive machinery formerly used.

Plant manager Gilligan and production foreman Rimmel have this to say about the performance of W-T presses. "Their slightly higher initial cost over competitive equipment has been more than offset by the high quality of work produced and the fact that we have had no maintenance problems with the presses."

Ask your W-T distributor to demonstrate what Walker-Turner "Light-Heavyweight" machine tools can do for you. He's listed under "Tools" in your telephone book. Or mail the coupon below for details.

walker-Turner

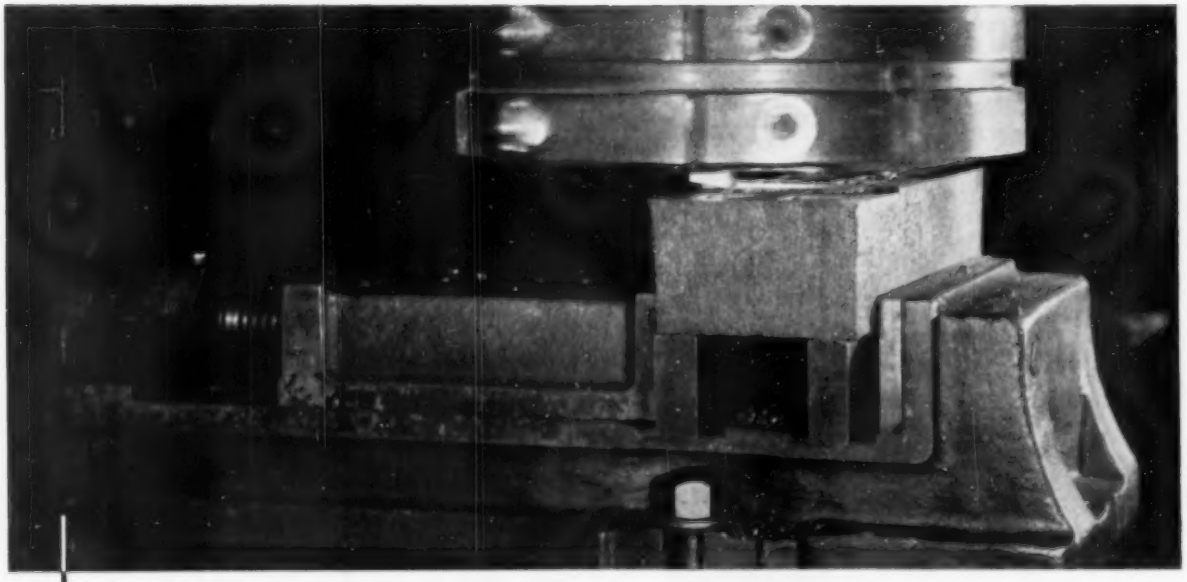
WALKER-TURNER
Division of Rockwell Manufacturing Co.
Dept. WD-25, 400 N. Lexington Ave., Pittsburgh 8, Pa.

☐ Please send name of my Walker-Turner distributor.
☐ Please send literature on Walker-Turner drill presses.

Name_____
Address_____
City_____ Zone____ State_____

On any material, any job . . .

INCREASE PRODUCTIVITY, CUT UNIT



Output boosted 20%-30% with Grade 860

Milling gray cast iron. Cemented carbide increased production, yet provided longer tool life, better finishes on the new hard, dense types of gray cast iron. Tests on simulated engine blocks (above) showed Grade 860 took interrupted cuts with minute wear, no chipping . . . while other carbides showed extensive chipping and cratering.

Production rate doubled with Grade 370 tool

Turning 4340 steel. High-impact cutting involved on this special aircraft shaft caused rapid dulling of conventional carbides; several work stoppages per shaft occurred while tools were reground. Today, Synchro Devices, Inc., turns a complete shaft with a single Grade 370 tool . . . also gets double the production.

Daily regrinding ended by Grade 883 cutters

Gang-milling plastics. Cotton-impregnated plastic-like plugboards were so abrasive that steel cutters were down for costly, time-consuming regrinding almost daily. Switching to Carboloy Grade 883, International Business Machines Corp. milled 900,000 boards with the carbide-tipped cutters without sharpening.

COSTS WITH CARBOLOY® CARBIDES

- Take heavier cuts, at faster speeds and feeds
- Lower tool cost per piece, boost machine efficiency

Whether you're cutting steel, cast iron, aluminum—or even nonmetallics like plastics—Carboloy carbide grades will keep machines running longer at top efficiency.

Carboloy cemented carbides make your machines more productive because they take greater speeds and feeds . . . give you more output per grind. And, they'll cut unit costs through lower downtime, grinding, and maintenance costs . . . give you more production per tool. It adds up to a more efficient – and therefore, more profitable – machining operation.

Wide choice of grades

If you're cutting steel, for example, use Carboloy Extra-Performance Grades 350 and 370. These grades have proved their superiority over conventional carbides in hundreds of applications . . . doubling and tripling production in many cases.

If you're milling high-tensile cast irons, there's Carboloy Grade 860. This carbide provides greater resistance to chipping and cratering. Tests show it can increase production 20%-30%.

Or, if you're machining nonferrous materials like aluminum, brass, bronze, or titanium, you can choose from five Carboloy cemented carbides . . . and get the specific cutting characteristics you need for any job from precision finishing to heavy-duty interrupted cuts.

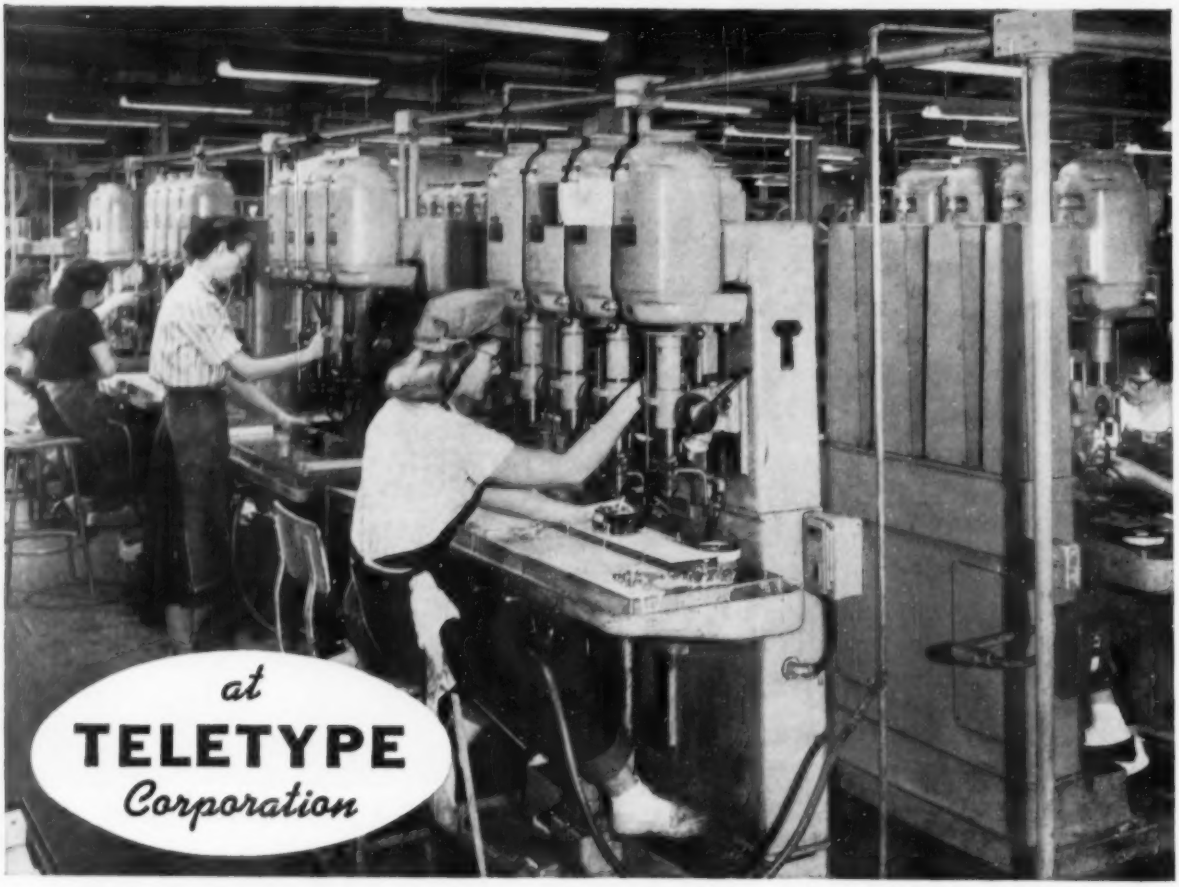
Broad range of products

Carboloy cemented carbides are locally stocked for immediate delivery by 139 Authorized Carboloy Distributors. They're available in the widest choice of styles and sizes in the industry.

Call your Distributor today (he's listed in the Yellow Pages). Or, send for a copy of Catalog GT-316, containing the new Grade Selection Guide for Carboloy cemented carbides. Write: *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Road, Detroit 32, Michigan.*

Progress Is Our Most Important Product

GENERAL ELECTRIC



Women Work Well with LELAND-GIFFORD Drilling Machines

At the dexterous finger touch of skilled women operators, these rugged he-man Leland-Gifford Drilling Machines perform miracles of precision drilling for Teletype Corporation.

Thousands of small precision parts for intricate Teletype machines require a wide variety of precision drilling operations — drilling through or to depth, tapping, countersinking, spot facing.

Batteries of Leland-Gifford Multiple Spindle Drilling Machines provide the extreme sensitivity plus infinite flexibility needed to handle these operations quickly, accurately and profitably. The right tools are always ready for use in the right sequence and combination. Work moves smoothly from one spindle to the next, requiring a minimum of handling even for the most complex pattern of holes.

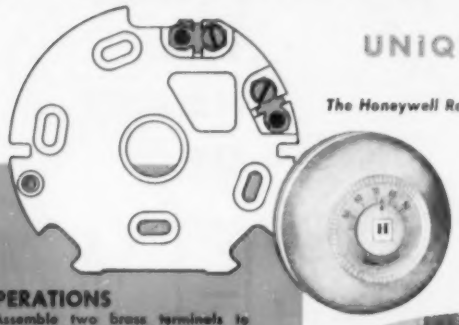
Walk through the plants of the nation's foremost producers of precision work and you'll find one name more than any other on precision drilling equipment — LELAND-GIFFORD. Leland-Gifford Multiple Spindle Drilling Machines are available in a complete family of sizes in a wide range of swings, number of spindles, types of feed. New bulletins give complete information. Write for them.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 45
2515 West Peterson Ave.
DETROIT
10429 West McNichols Rd.
CLEVELAND 22
P.O. Box 853
NEW YORK OFFICE
75 South Orange Ave.
South Orange, N. J.
LOS ANGELES OFFICE
2620 Leonis Blvd.
Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

Bodine CASE HISTORY NO. 40

UNIQUE TOOLING SAVES 90% LABOR



The Honeywell Round

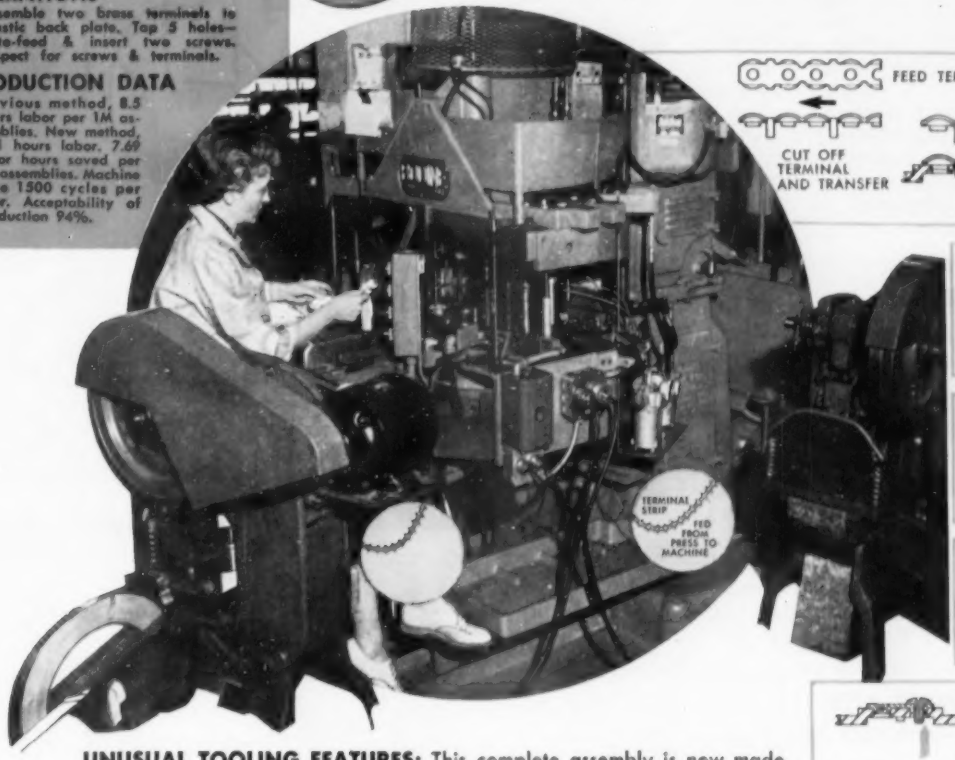
Minneapolis-Honeywell's attractive room thermostat depends upon this unique tooling set-up for economical volume production of the plastic back plate terminal block assembly shown at left. Labor hours have been reduced to about ONE TENTH of previous operations, thanks to this Bodine 42-30 Machine. It's just one example of the versatility of Bodine machines as they lend themselves for special tooling to meet specific job requirements.

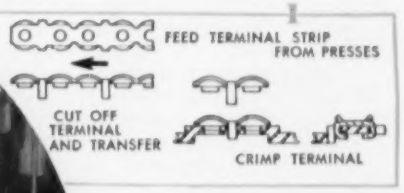
OPERATIONS

Assemble two brass terminals to plastic back plate. Tap 5 holes—auto-feed & insert two screws. Inspect for screws & terminals.

PRODUCTION DATA

Previous method, 8.5 hours labor per 1M assemblies. New method, 0.81 hours labor. 7.69 labor hours saved per 1M assemblies. Machine time 1500 cycles per hour. Acceptability of production 94%.





UNUSUAL TOOLING FEATURES: This complete assembly is now made in one cycle of a Bodine 42-30 Machine. The two presses stamping the terminal blanks are coupled to and cycled by the machine, feeding stampings continuously as shown. Terminals are cut-off, inserted and formed over at station one. Back plates are magazine fed. Operator's functions are largely limited to keeping back plate magazine filled and replenishing coils of brass stock on presses.

At end of operation, two inspection probes, advanced from below, test for properly filled screw terminal holes, automatically discard rejects.

With today's demand for cost-saving through grouping of assembly operations, Bodine's extensive experience in the field will prove profitably useful. We invite inquiries. Send your ideas and samples for analysis to Dept. TE-4.

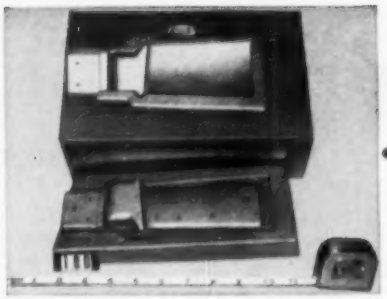
"You Can't Meet Tomorrow's Competition With Yesterday's Machine Tools."

THE Bodine CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

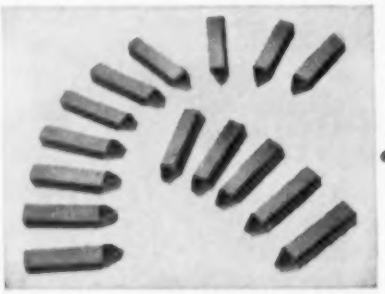
FORGING DIE

Material: Heppenstall 'A'
Conventional Machining
Time: 40 hours
Elox Setup & Machining
Time: 8 hours
Saved: 32 hours
Machine tool: Elox Standard M-500
Electrode: Cast Elo-met #3
Customers report 75% time saving in re-working dies after washout . . . no annealing is necessary.



TUNGSTEN CARBIDE SINGLE POINT TOOLS

E D M produces 14 identically machined tools per hour. Times include roughing and finishing, machining both faces, nose radius and top. Radius held to ± .001". Tools were produced by 1 man operating 2 Elox Tool & Cutter Grinders, using a brass wheel. Users report Elox ground tools give greatly increased life when compared to abrasive ground tools.



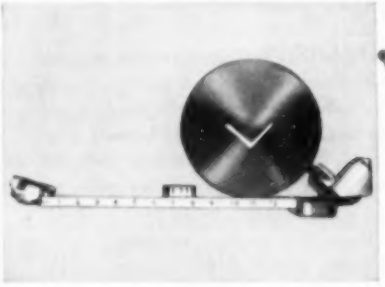
EMBOSSING DIE

Material: Air Hardened Tool Steel
Die consists of 1,250 squares machined .100" x .030" deep in the bottom section of the die. Sharp corners on each square had to be maintained.

Conventional Machining
Time: 227 hours
Elox Setup & Machining
Time: 10 hours
Saved: 217 hours
Machine Tool: Elox Standard M-500
Electrode: Free machining brass

EXTRUSION DIE

Material: Air Hardened Tool Steel
Conventional
Machining Time: 4 hours
Elox Setup &
Machining Time: 1 hr. 38 min.
Saved: 2 Hrs. 22 min.
Machine Tool: Elox Standard M-500
Electrode: Free machining brass
Machining is done after final heat treating . . . eliminating the possibility of distortion.



FROM THE HEART OF

EDM

. . . 4 jobs that prove

Elox puts you ahead of competition

These jobs were done for Elox customers in our "Prove It" Division. There's more to them than just "man hours" saved. The Elox sales engineer in your area would like to give you all the details about these and other applications of Electrical Discharge Machining. Why not write . . .

elox corporation of michigan *T. M. Reg.

1837 N. Stephenson Highway
Royal Oak 3, Michigan

TOOL ENGINEERS:

Here's why it pays to specify

CHALLENGE

when you need precision surface equipment

1. CHALLENGE OFFERS THE MOST COMPLETE LINE . . .

of standard precision surface equipment. Over 300 different sizes and types of standard angle plates, box parallels, V blocks, layout plates, straight edges, semi-steel and granite surface plates and many other items designed to improve your tooling, inspection, production or assembly operation.

2. COMPLETELY CATALOGED . . .

to help you select the right equipment for each precision job. Most of the Challenge precision equipment is either carried in stock by your local Mill Supply Distributor or is otherwise readily available for prompt delivery.

3. PLUS ENGINEERING HELP . . .

in applying Challenge Surface Equipment to your special problems, particularly on installations of large surface or floor plates which must be specially engineered. Factory trained engineers and, in some areas, special technical representatives are available for help.

For complete information or a copy of the Challenge Precision Catalog (No. 838W) write today to:

THE CHALLENGE MACHINERY COMPANY
GRAND HAVEN, MICHIGAN

Challenge®

TE-100

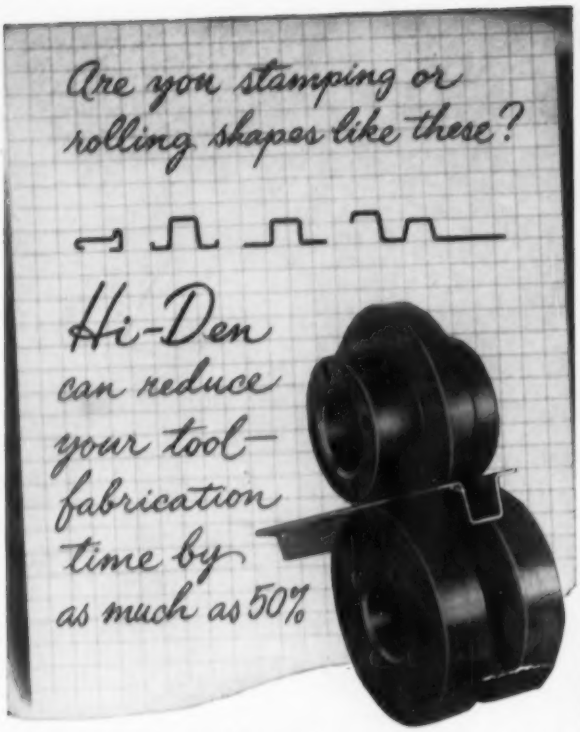
THE CHALLENGE MACHINERY COMPANY
Grand Haven, Michigan **TE-4**

Please send Challenge Precision Catalog No. 838W

Name_____

Address_____

City_____ State_____



A large aircraft manufacturer* reports HI-DEN rolls in a Yoder machine produced these short-run parts in stock sheared from sheet aluminum (in as-quenched condition) more satisfactorily and economically than other methods tested. And *tool fabrication time was reduced* 50%.

Another company* found that a steel draw die which formerly required three passes to complete a draw, when faced with HI-DEN completed the same draw in one pass. HI-DEN *treats the metal better.*

More than 100 different applications for HI-DEN have been reported by users . . . forming, stretch, draw and press brake dies; jigs, fixtures, templates, pressure pads and many others. Ideal for use in Hydro-form or Mar-form presses.

HI-DEN, a compreg of selected wood veneers impregnated with phenolic resin (laminated and compressed under extreme heat and pressure) is far stronger than equal weight in steel, is lighter in weight, easier to handle, resistant to oil, alcohol and moisture, dimensionally stable — and is easily shaped with standard tungsten carbide tools.

**Names on request*

If you are forming light metal parts, HI-DEN has important advantages to offer. Why not send today for Technical Bulletin and literature showing how to improve quality while lowering costs?

P.S. HI-DEN's companion product, Parkwood 8800 (a kraft paper impregnated laminate) is becoming popular for bench tops . . . smooth, hard, but resilient, it won't burr and scratch assemblies of aluminum alloy and other softer metals.

Parkwood Laminates, INC.

32 Water St., Wakefield, Massachusetts

USE READER SERVICE CARD; INDICATE A-4-276-1

announcing . . .

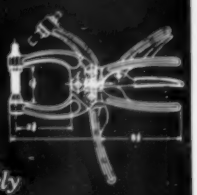
TRIGGER-RELEASE levers on 5 more

DE-STA-CO

PORTABLE **TOGGLE CLAMPS**

MODEL 462

Trigger-Release levers also available on DE-STA-CO Toggle Clamp Models 461, 462-S, 463, and 463-S (jaw spans ranging from ½" to 3").



For a one-handed clamping job . . . especially in a hard-to-get-at place . . . there's *nothing, absolutely nothing,* as good as a Trigger-Release DE-STA-CO Portable Clamp! . . . And now, with 5 more new models, we meet practically every such clamping requirement.

FOR COMPLETE INFORMATION, WRITE FOR 40-PAGE CATALOG AND NEAREST DE-STA-CO DEALER!...

DE-STA-CO **DETROIT STAMPING COMPANY**

WORLD'S FIRST LINE OF TOGGLE CLAMPS

328 Midland Avenue • Detroit 3, Michigan

USE READER SERVICE CARD; INDICATE A-4-276-2

Thompson Products Inc. | *West Coast Division*

tapping production DOUBLED in pieces per hour with longer tool life

KAUFMAN

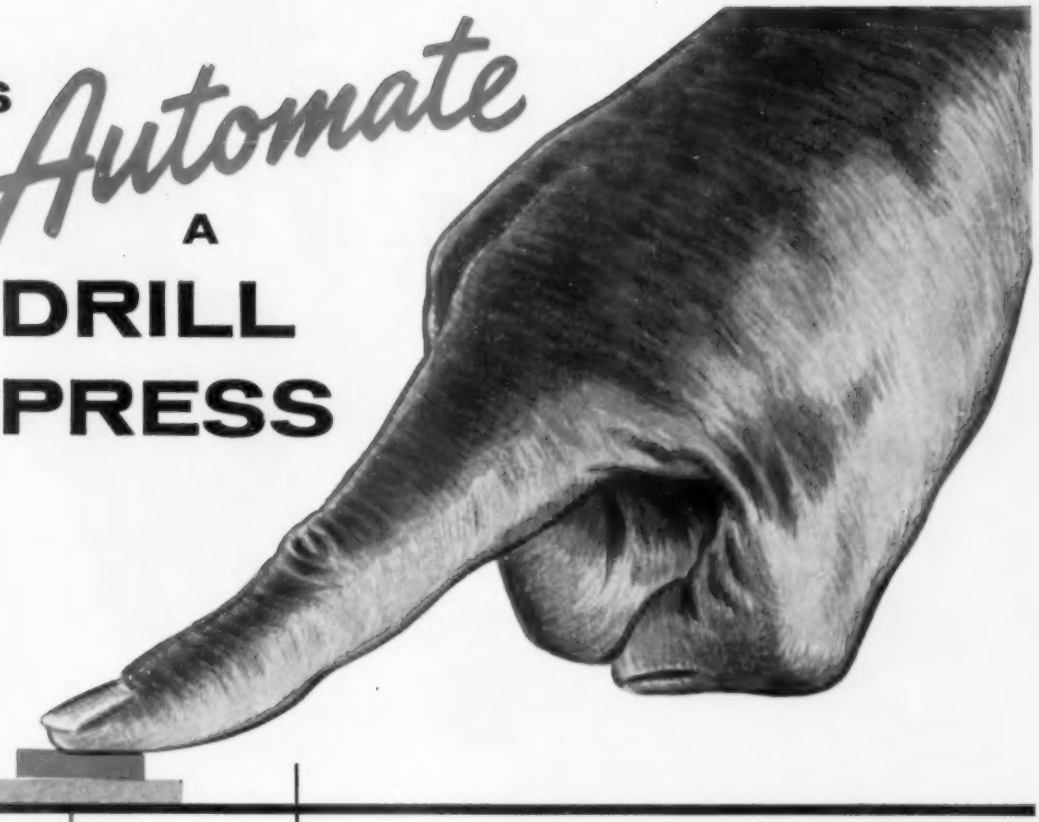
There's a good reason for that kind of a record. *Kaufman specializes in building tapping machines* . . . highly-precisioned machines designed for high production runs or for the versatile, multiple machine shop requirements. For complete information on how you can reduce production costs in your plant . . . send prints and samples of your work to

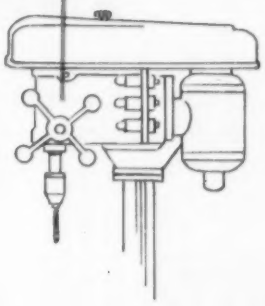
KAUFMAN MFG. CO.

553 S. 29th St. Manitowoc, Wisconsin

USE READER SERVICE CARD; INDICATE A-4-276-3

LET'S *Automate* A DRILL PRESS





Like to know more about it?

These two free booklets tell the entire story. Write for them today. Address: Dept. **TE-457**, The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

There are more hand fed drill presses in use than any other machine tool. They are all pretty much alike. The operator positions the work in a jig or fixture, feeds the drill in and out of the work by turning a star wheel by hand, and removes the work from the jig.

A good workman can drill a clean hole. But not too many of them. It's a tiring job. Towards the end of the shift both quality and quantity suffer.

Let's put a Bellows Drill Press Feed on the star wheel shaft. Now, the operator touches a lever. Automatically the drill is fed in and out of the work, under perfect control. Production is increased 20%-30%; quality is better; tool life longer.

Let's go a step farther. Add a Bellows Rotary Feed Table. Now all the operator has to do is load parts. The table automatically positions the part under the drill. the drill press feed automatically feeds the tool, the table indexes to eject one part and position another. Production is more than doubled, often more than tripled.

How much does such a set-up cost? Roughly five weeks wages of an operator buys it. Actually it costs nothing. It pays for itself, often with the first week's cost savings.

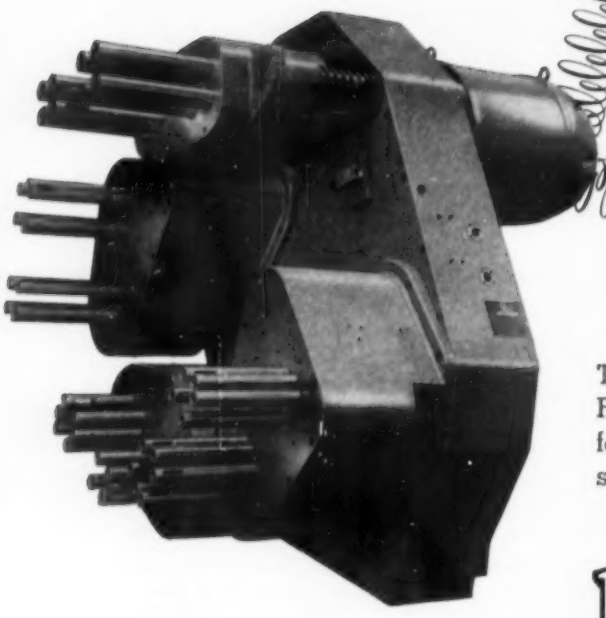
The Bellows Co.

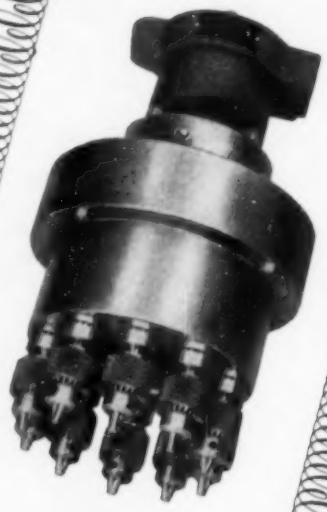
AKRON 9, OHIO

MANUFACTURERS OF CONTROLLED-AIR-POWER DEVICES FOR FASTER, SAFER, BETTER AND **LOWER-COST** PRODUCTION

767B

FROM THEN...
...TO ETERNITY





1924

The U. S. Drill Head Company's first Fixed Center Drill Head was produced for Borg and Beck, of Chicago — a subsidiary of Borg-Warner.

1957

The 50,000th Head was shipped.

For men who know drill heads best, it's always U. S. Drill Head ...5 to 1

Since 1915, when the U. S. Drill Head Co. built its first adjustable head, it has far surpassed all other similar manufacturers because of its engineering and production facilities.

Manufacturers of all types of adjustable, fixed center and individual lead screw tapping heads.

US DRILL HEAD

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

Tear this chart out and preserve it

YOUR GUIDE TO COLUMBIA HOT WORK TOOL STEEL GRADES

TYPE AND GRADES	DESCRIPTION	HARDENING RANGE	QUENCH	TEMPERING RANGE	USEFUL HARDNESS
T1 — CLARITE HW	Full tungsten hot work steel with modified carbon and vanadium for highest resistance to softening at elevated temperatures with best wear resistance and medium toughness.	2100° F. to 2250° F.	Oil or Salt Bath	1050° F. to 1250° F.	58/52 Rc
H24 — FORMITE NO. 3	A high tungsten hot work steel with good heat resistance to softening and wear, good toughness.	2000° F. to 2200° F.	Oil or Air	1050° F. to 1250° F.	56/48 Rc
H21 — FORMITE NO. 2	Reduced tungsten hot work steel with good resistance to softening and wear and high toughness.	2000° F. to 2200° F.	Oil or Air	1100° F. to 1250° F.	54/42 Rc
M10 — MOLITE HW10	A high molybdenum 2% vanadium steel with modified carbon for high resistance to softening and good wear resistance with high toughness.	1800° F. to 2100° F.	Oil or Air	1100° F. to 1250° F.	56/48 Rc
H13 — VANADIUM FIREDIE	Air hardening chromium molybdenum 1% vanadium for die casting aluminum, may be water cooled.	1825° F. to 1900° F.	Air	1000° F. to 1200° F.	52/38 Rc
H12 — ALCODIE	Chromium molybdenum tungsten vanadium air hardening hot work steel, resists softening with good resistance to wear and heat checking	1825° F. to 1875° F.	Air	1000° F. to 1200° F.	52/38 Rc
H11 — FIREDIE	Chromium molybdenum with 1/2 % vanadium air hardening type with widest range of uses, good resistance to softening and wear with high toughness and may be water cooled.	1800° F. to 1850° F.	Air	1000° F. to 1200° F.	52/38 Rc

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILLINOIS

CENTRAL OFFICE AND WORKS, CHICAGO HEIGHTS, ILLINOIS — BRANCH STOCKS IN THE FOLLOWING CITIES:

1957

Chicago 32 — 4832 S. Kedzie Ave. — Phone LAfayette 3-3632
Cincinnati 25 — 2716 Spring Grove Ave. — Phone MUlberry 1-8400
Cleveland 14 — 1640 St. Clair Ave. — Phone MAin 1-1785
Detroit 3 — 121 Oakman Blvd. — Phone TUlsa 3-3770
Los Angeles 22 — 6955 E. Bandini Blvd. — Phone RAymond 3-4684
Milwaukee 4 — 426 S. Sixth St. — Phone BRoadway 6-0255
St. Louis 13 — 5118 Easton Ave. — Phone FOrest 1-0641

REPRESENTATIVES IN THE FOLLOWING CITIES: Dayton, Erie, Grand Rapids, Hartford, Indianapolis, Louisville, Moline, Newark, Portland and St. Paul

COLUMBIA TOOL STEELS

DIE STEELS: Superdie — Atmodie — E-Z-Die Smoothcut — Exl-Die — CEC Smoothcut CARBON TOOL STEELS: Columbia Special — Vanadium Extra — Waterdie Extra — Columbia Extra — Columbia Extra Headerdie — Vanadium Standard — Colmbia Standard HIGH SPEED STEELS: Clarite — Vanite — Acmite — Cobite — Maxite — Molite Smoothcut — Molite #3

AUTOMATIC *Air-Borne* LUBRICATION

FOR ALL ELEMENTS OF A MACHINE

One Lubricator Per Machine – Model 33AL-4 (½") Lubrication Unit automatically creates finely divided air-borne oil fog. Completely lubricates a machine having a maximum requirement of 100 bearing inches.

Better Lubrication – Continuously applies protective film of fresh oil to lubrication points. Never periods of too much or too little lubrication.

Compact, Complete, Attractive – Measuring only 6-1/32" x 6-1/32" x 5-3/16", cabinet contains air filter, pressure regulator, MICRO-FOG Lubricator.

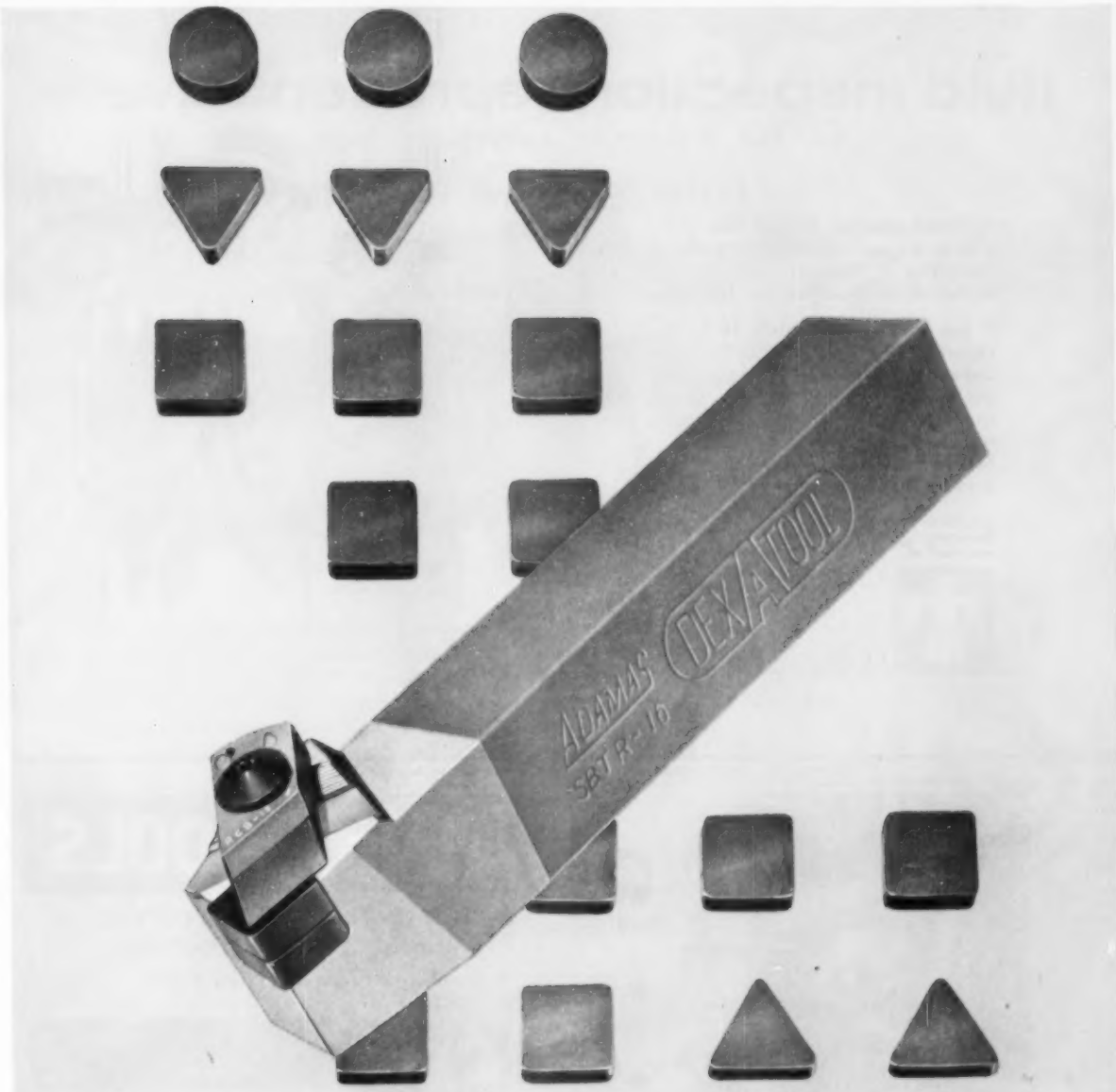
Visual Oil Feed – Oil feed is readily visible, providing positive proof of lubrication. No guesswork.

For complete information on MICRO-FOG Lubrication for all bearing inch requirements, call your nearby Norgren Representative listed in the telephone directory – or WRITE FOR FACTORY LITERATURE.

MICRO-FOG by Norgren

C. A. NORGREN CO.

3447 SOUTH ELATI STREET • ENGLEWOOD, COLORADO



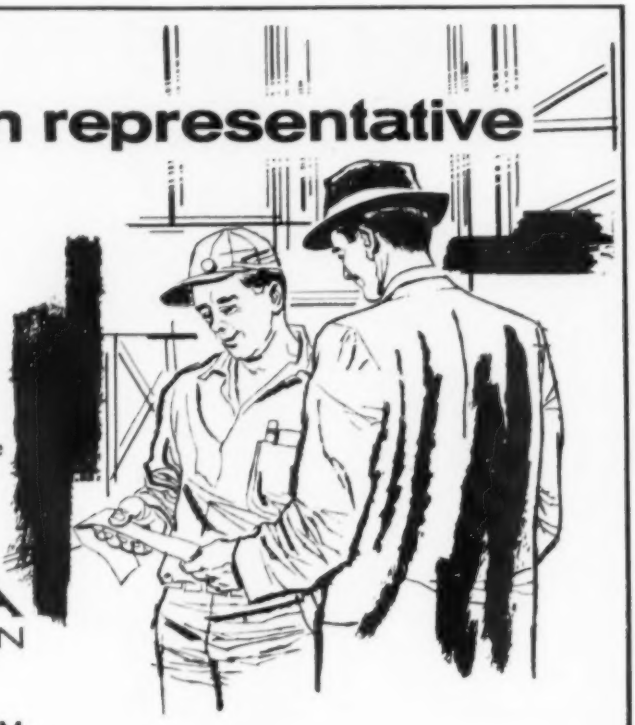
4 WAYS BETTER

- Fully adjustable chipbreaker
- Invertible and indexable carbide or steel anvils
- Holds both 3/16" "thick" inserts and 1/8" "thin" inserts
- Choice of standard or setscrew chipbreaker clamps

ADAMAS CARBIDE CORPORATION, KENILWORTH, N. J.

PRODUCERS OF TUNGSTEN CARBIDE TOOLS, TOOL TIPS, DIES, WEAR PARTS, DEX-A-TOOL AND CERALOX.

field inspection representative



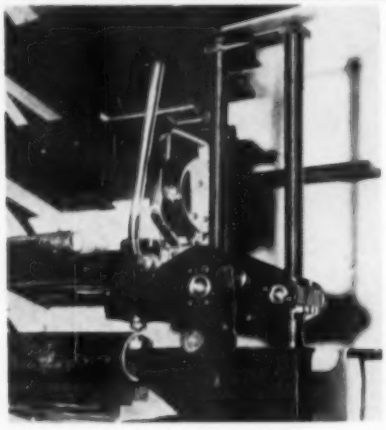
We need capable, mature men who have good judgment, to perform inspection at subcontractors in the Midwest and on the East Coast.

If you have approximately 10 years experience in electrical and electronic inspection, with some machine shop background, and want to work for a stable firm, specializing in nuclear weapons research and development, write Mr. J. Danclovic, General Employment Section 594.

SANDIA CORPORATION

ALBUQUERQUE, N. M.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-282-1



Accuracy in Hardness Tests insures Quality Control

Solve quality control problems with the King Portable Brinell Hardness Tester. Take faster, more accurate hardness readings on heavy, odd-shaped metal parts without elaborate fixturing or cutting samples. The King Portable uses a 3000 kg. load on a 10 mm. ball with automatic relief. Intermediate loads as desired. This precision instrument saves handling and set-up time, and is so versatile, it soon pays for itself many times over. Weighs less than 30 pounds and makes guaranteed accurate tests anywhere.

For complete specifications on standard testing machines or adaptations made to your special requirements, write

KING TESTER CORPORATION

Dept. T, 440 North 13th St., Philadelphia 23, Pa.

USE READER SERVICE CARD; INDICATE A-4-282-2

APEX TOOLS

INSERTED-BLADE MILLING CUTTERS AND SINGLE-POINT TOOLS FOR ALL METAL-CUTTING NEEDS

APEX TOOL BITS FIT MOST STANDARD HOLDERS

If you haven't yet changed to Apex, you can begin to get acquainted by using Apex Bits in your present holders. The Apex line includes Single-Point Round Shank (as shown) and Shankless Serrated — plus Inserted-Blade Milling Cutters of all different styles. Write for catalog.

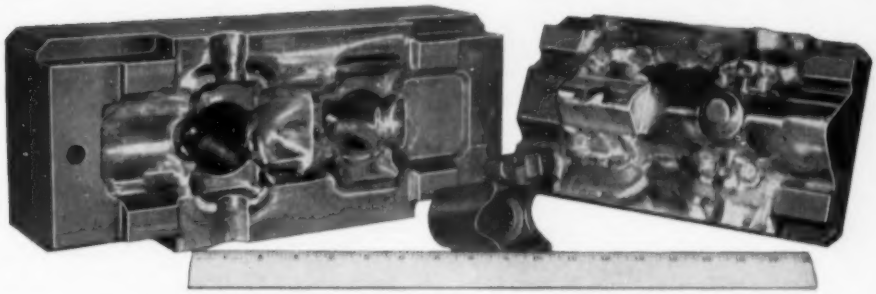
PROMPT SHIPMENT FROM OUR LARGE COMPLETE STOCK

APEX TOOL & CUTTER CO., Inc., Shelton 16, Conn.

USE READER SERVICE CARD; INDICATE A-4-282-3

Manufacturing Engineers:

. . . and for forging dies and inserts, Latrobe's LPD is used for tough jobs!



Two station press insert manufactured and used by Ford Motor's Forging Plant in Canton, Ohio. It was made from Latrobe's LPD hot work die steel and is used to produce the Universal Flange Joint in the Drive Shaft Assembly of the 1957 Ford. The material being forged is SAE 1141 which is forged on a 2,000 ton forging press at a temperature of 2240° F.

The top and bottom inserts are heat treated to a hardness of Rockwell C 38-40. Average production for the top insert is approximately 16,000 pieces and for the bottom insert 8,000 pieces.

FORD MOTOR COMPANY Forging Plant
Canton, Ohio

uses LPD

for this job because . . .

1. LPD has a proper balance of toughness, hardness, and abrasion resistance to withstand severe working conditions at high temperatures.
2. LPD is resistant to heat checking at elevated temperatures.
3. LPD is available in a wide range of sizes.

Latrobe's LPD Hot Work Die Steel is a chromium-tungsten general purpose hot work steel possessing a fine balance of properties for high temperature work. It is an air hardening non-deforming steel with excellent machinability characteristics.

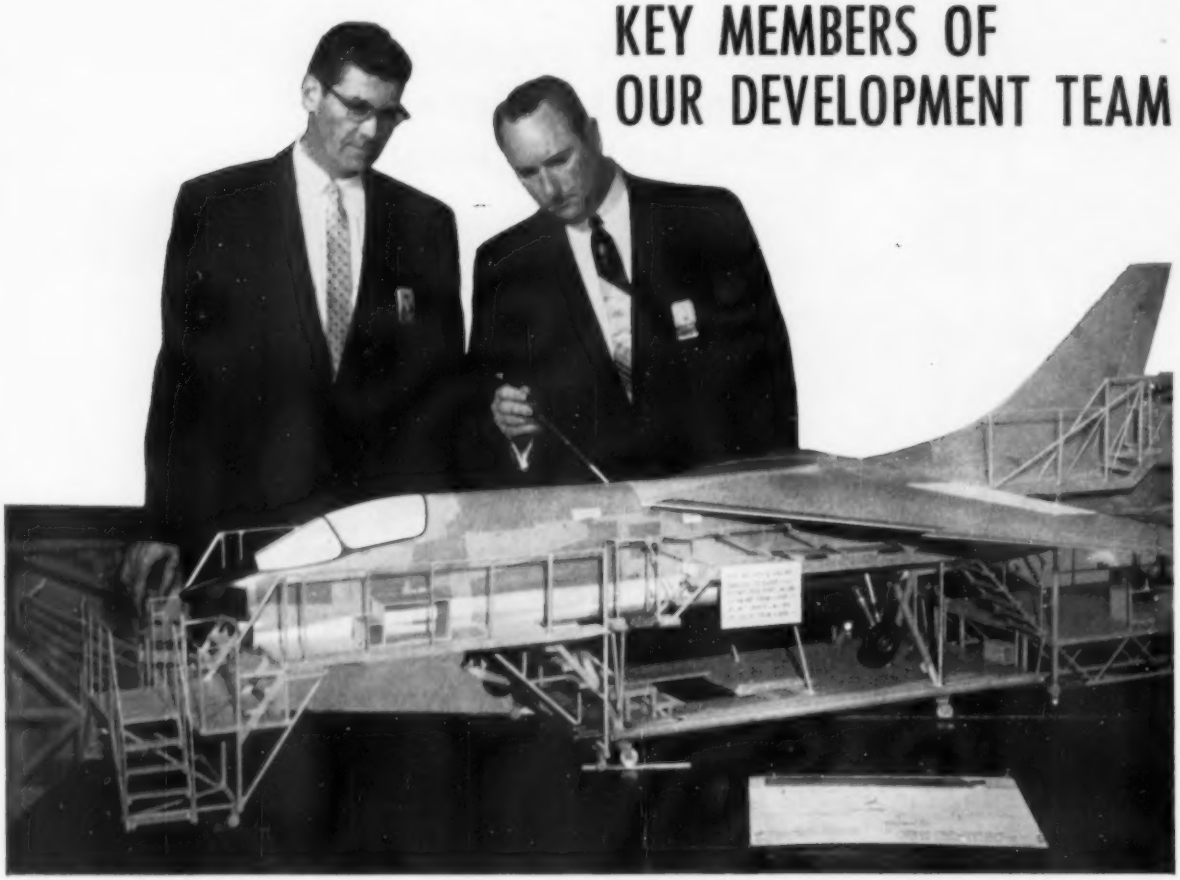
For your next hot work forging die or insert . . . use LPD. Call your Latrobe representative . . . a wide range of sizes are carried in warehouse stocks.

LATROBE
STEEL COMPANY
MAIN OFFICE and PLANT
LATROBE, PA.

Branch Offices and Warehouses Located in Principal Cities

Manufacturing Engineers:

KEY MEMBERS OF OUR DEVELOPMENT TEAM



Early in the development of any new weapon, this question comes up: *is it a producible idea?* Can parts be manufactured to prescribed specs? Does the design, for example, consider bend allowances? And—looking further ahead—can the product be broken down for efficient production? At Chance Vought, these questions are answered by manufacturing engineers on our development team. It's the first of many assignments these professionals undertake in the development of Vought fighters and missiles. Once they've determined that a weapon's producible, then they must make it digestible to the shop. They tailor tooling to prescribed production flow, and they create new machinery for special jobs. They sequence parts fabrication and assembly, and they conduct continuous research into new materials and production techniques. As a result of this research, production at Vought is an ever-changing, advancing program. For creative mechanical, industrial, electrical and civil engineers, it's an exciting, fast-moving career field.

Manufacturing research engineers at Vought design special techniques and forming equipment for materials like high tensile steel, titanium and honeycomb. Here's a Vought-designed model which guided construction of a big hot-forming press for titanium. Examining, are Bill Wood, left, manufacturing research supervisor, and Joe Bayer, manufacturing research engineer.

Turn tax savings into family fun in Dallas where the local tax rate is one of the nation's lowest. Here you can live within a short drive of your office, and mild year-'round weather adds to outdoor enjoyment.

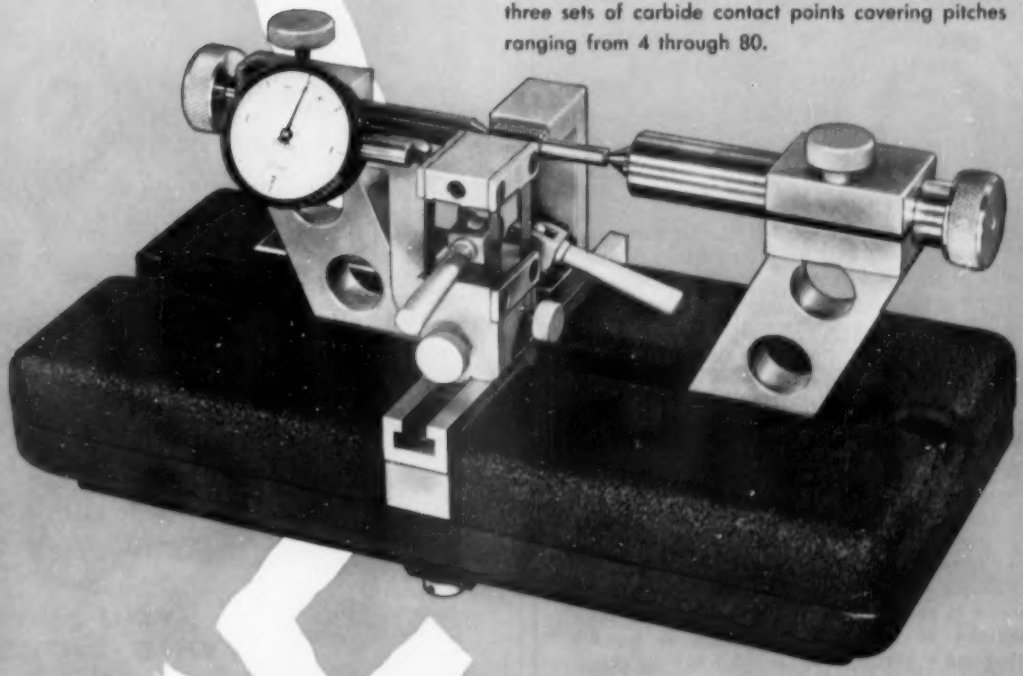
To arrange for a personal interview, or a prompt report on our opportunities in Manufacturing Engineering, write: MR. AL STERLING, Supervisor Employment and Placement

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

NEW!
DRUNKEN THREAD CHECKER

Now, with the PMCo Drunken Thread Checker, it is possible to accurately check another element—"drunken threads." This new instrument, developed after many years of study, is manufactured of the finest materials, by a team of expert craftsmen. It simplifies accurate reading of helix deviation.

The PMCo Drunken Thread Checker has a capacity up to 3¾" diameter. Maximum measuring distance between centers is 5⅝". It is furnished complete with three sets of carbide contact points covering pitches ranging from 4 through 80.



THE PIPE MACHINERY CO.
29100 Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland

Today Get the Pipe Machinery Co. "Drunken Thread Checker" Pamphlet #2. Fill in this coupon.

Name _____
Company _____ Title _____
Address _____
City _____ Zone _____ State _____

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

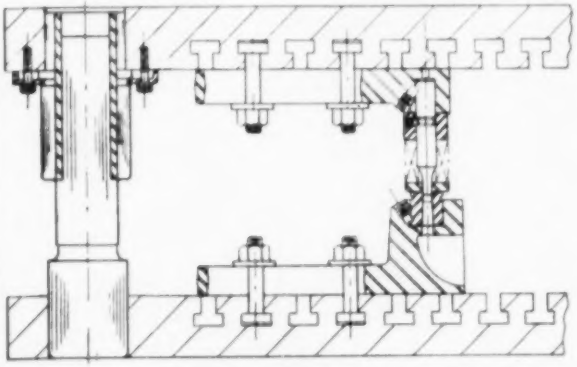
See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY
ABERDEEN, SOUTH DAKOTA

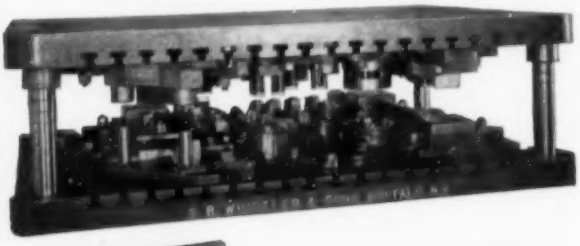
USE READER SERVICE CARD; INDICATE A-286-1

ADJUSTABLE DIES *by* WHISTLER

• Operate like a single purpose die • Easy to set-up and make changes • Interchangeable and re-usable parts always ready for a new job • Reduce die costs to a new low • Pierce holes in any desired arrangement of shapes and sizes • Precision piercing of materials to ¼" thick steel.



Above: Sectional drawing of a Whistler adjustable punch and die unit assembled in T-slot die set. **Below:** A completely assembled Whistler adjustable die ready for the press.



YOU NEED THIS CATALOG

to see for yourself in dollars and cents what this adjustable die making method can do for your plant. Send for it right now...without obligation.

S. B. WHISTLER & SONS, INC.
744 Military Road, Buffalo 23, N. Y.

ADJUSTABLE, MAGNETIC and CUSTOM DIES FOR ALL INDUSTRY
Direct Factory Representatives Located in Principal Industrial Areas

USE READER SERVICE CARD; INDICATE A-286-2

WHY PAY MORE
for specials, when you can get what you need FROM STOCK?

Design around
BOSTON Gear
100 SERIES
SPEED REDUCERS
1605
types and ratios
FROM STOCK

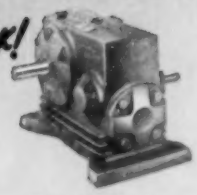
Horizontal Right Angle Drive
Worm Gear over

Horizontal Right Angle Drive
Worm Gear under

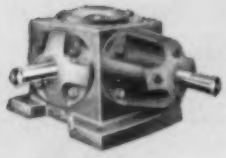
REDUCTORS Ratios 1:1 to 3600:1 — .004 to 50 HP

Vertical Right Angle Drive

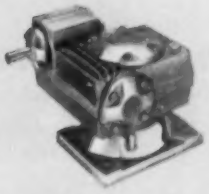
FROM STOCK!



Double Reduction
Horizontal Parallel Drive



Horizontal Right Angle Drive



Double Reduction
Vertical Right Angle Drive

Horizontal Right Angle Drive

Double Reduction
Horizontal Parallel Drive

RATIOMOTORS Output RPM .49 to 175

Vertical Right Angle Drive

FROM STOCK!

Double Reduction
Vertical Right Angle Drive

All Ratiomotors also sold without motors as
FLANGED REDUCTORS

FROM STOCK!

You buy and attach your choice of motor

And now MORE SIZES in small REDUCTORS

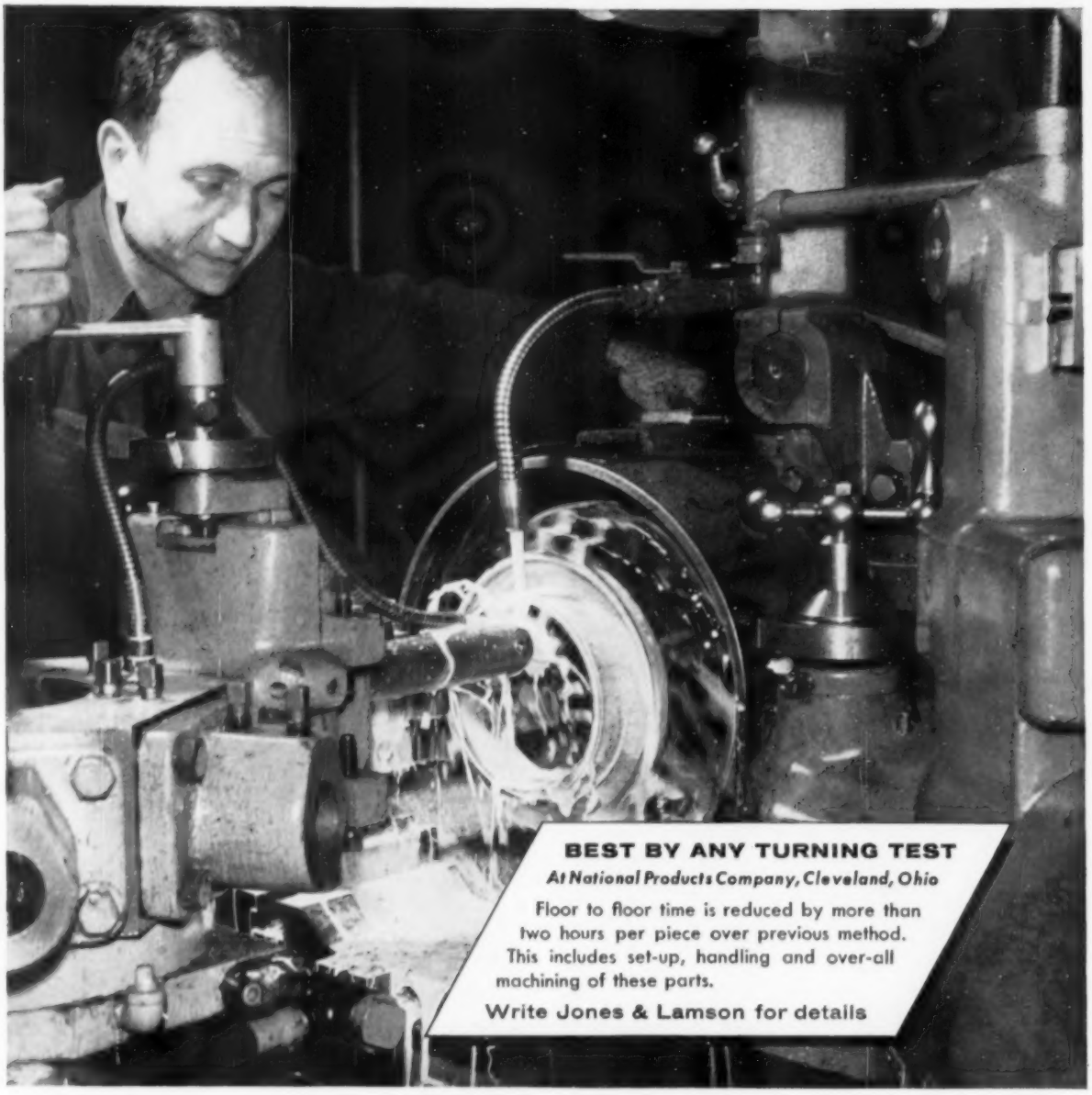
Meet increasing needs for smaller units in Horizontal Right Angle Drive models. Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

Catalog No. 56
lists full specifications, includes 50 pages of engineering data to aid in selection and application.

CALL YOUR BOSTON Gear DISTRIBUTOR

For nearest Distributor, look under "GEARS" in the Yellow Pages of your Telephone Book

57BG-RR-31


BEST BY ANY TURNING TEST
At National Products Company, Cleveland, Ohio
Floor to floor time is reduced by more than two hours per piece over previous method. This includes set-up, handling and over-all machining of these parts.
Write Jones & Lamson for details

Jones & Lamson turret lathes are built and powered to produce *MORE CHIPS per tool*
MORE PIECES per hour
MORE PROFIT per job
than any other turret lathe of comparable size!

JONES & LAMSON

the man who needs a new machine tool is already paying for it

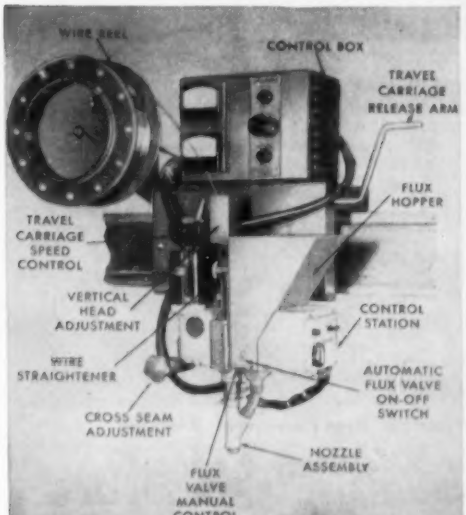
JONES & LAMSON MACHINE COMPANY, 518 Clinton St., Springfield, Vt., U.S.A. J&L MACHINE TOOL DIV.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-288

Production Increased 35%
with LINCOLNWELD
Automatic Submerged Arc Welder

HERE steering knuckles for tractors are produced by Lincolnwelding a forging to a spindle. Production has been increased from 56 to 76 pieces per hour. Welding cost has been reduced $1.80 per hundred pieces.

Cost reducing benefits like these are possible on many types of fabrication with the dependable Automatic Lincolnweld. Call in the Lincoln Welding Engineer in your city. Ask him for a recommendation of how Lincolnweld can cut your costs.



Welding steering knuckles for tractors with LINCOLNWELD automatic submerged arc welder. Courtesy of International Harvester Company, Milwaukee, Wisconsin.

THE
LINCOLN ELECTRIC
COMPANY
Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

For details and specifications of Automatic Lincolnwelds, send coupon for Bulletin SB-1355.

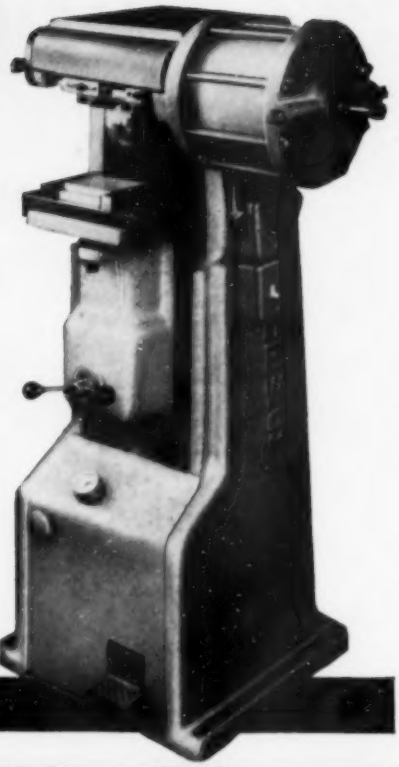
Fill out and mail to:
The Lincoln Electric Company
Dept. 5014, Cleveland 17, Ohio
☐ Send Bulletin SB-1355.
☐ Have Welding Engineer call.

Name_____
Company_____
Street_____
City_____ Zone____ State_____
Position_____

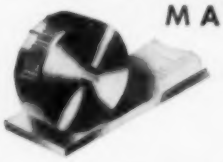
MARKING MACHINES

for every marking need

Matthews' standard line of Machines reflects hundreds of industrial marking applications . . . light to heavy duty requirements . . . production schedules requiring tens to thousands of marked parts per hour. In addition, Matthews' engineering staff is constantly developing specialized "in-line" marking equipment for use in automated or semi-automated production lines. Whatever your marking requirements may be, there's a Matthews' Marking Machine to do the job!



MARKING DIES



Roller style marking dies . . . for indenting flat or contoured surfaces with graduations, knurls or any desired lettering. Each die is subjected to a 100% inspection to assure the finest quality possible.

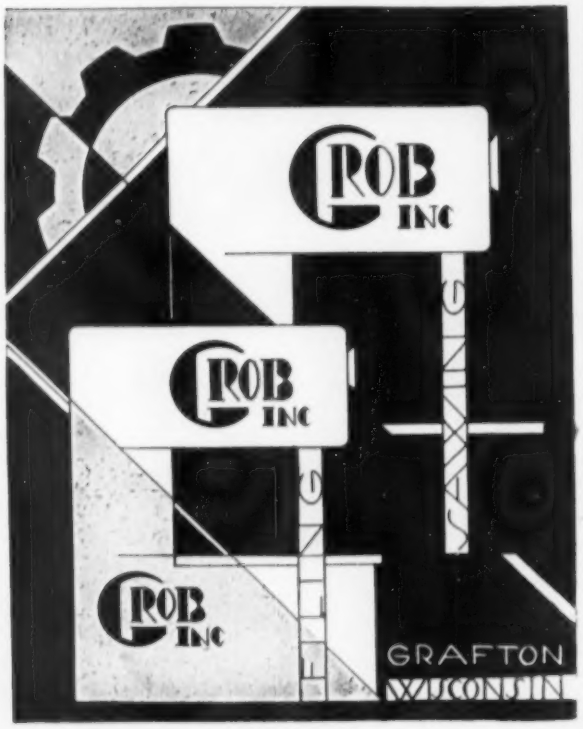
Press style dies by Matthews are designed specifically to your needs. All possible details are considered in the design, steel, engraving and heat treatment. These important factors provide maximum effectiveness in producing the stamped impression.

JAS. H. MATTHEWS & CO.

3923 Forbes St. Pittsburgh 13, Pa.

PHILADELPHIA • CHICAGO • CLIFTON, N. J. • BOSTON • JACKSONVILLE

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-290-1



USE READER SERVICE CARD; INDICATE A-4-290-2

MIDDLESTADT -- BALTIMORE

TOOLS - DIES - FIXTURES
SPECIAL MACHINERY
PRECISION MACHINING

DESIGNERS - MANUFACTURERS

Write for New Descriptive Brochure

The Middlestadt Machine Co.

4210 Chesmont Ave. Baltimore 6, Md.

USE READER SERVICE CARD; INDICATE A-4-290-3

DIE BOOK

CONTAINS CONDENSED PRACTICAL AIDS FOR EXPERIENCED

Revised Edition **DIE MAKERS**

Contains Answers to Over 1000 Practical Die Problems With Use of Direct Reading Tables and Formulas.

ALL IN ONE COMPACT HANDBOOK . . . direct answers to die problems. Saves time. Eliminates mathematical calculations. Avoids costly errors. Contains invaluable formulas and tables for quick reference.

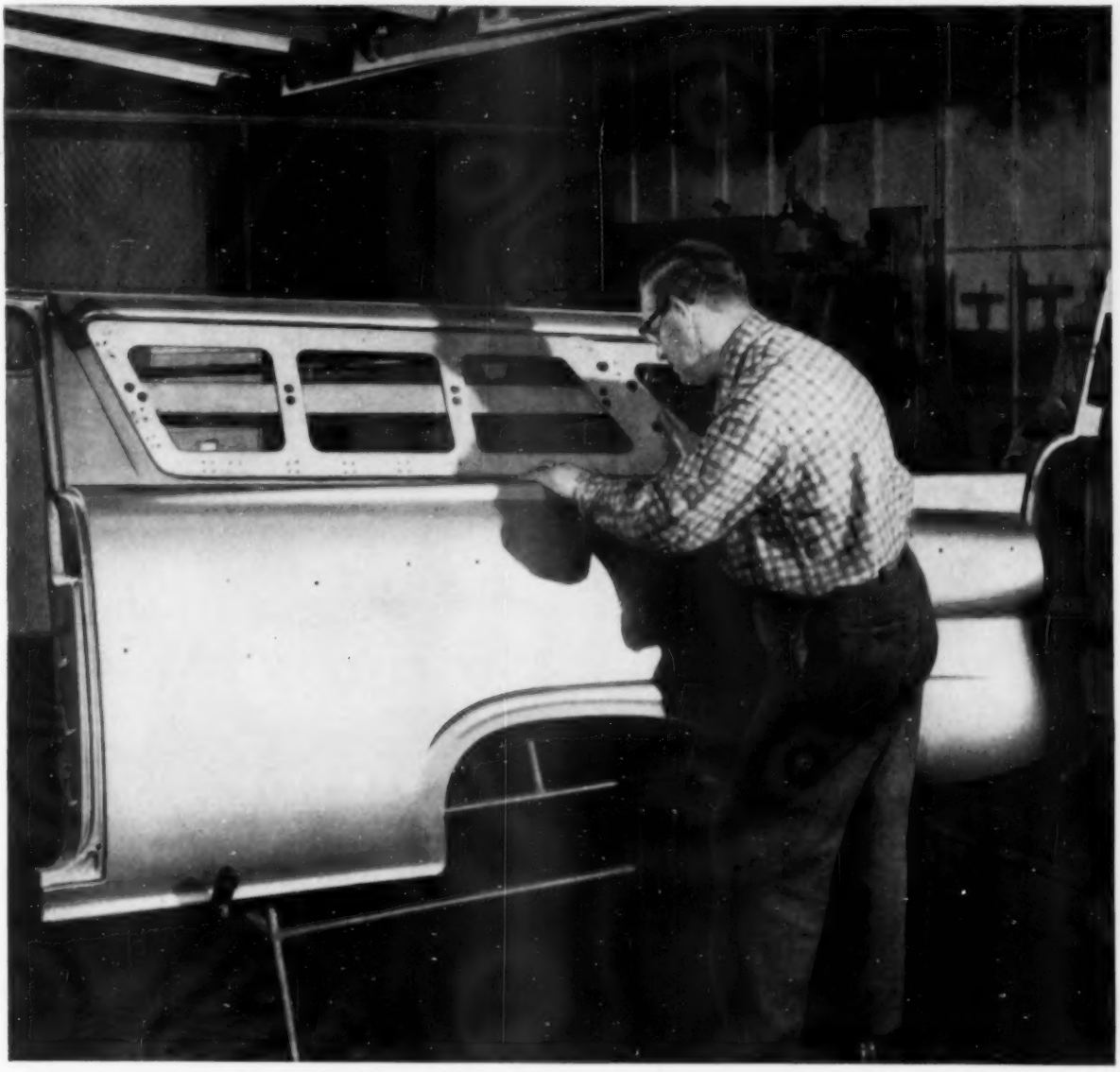
Formulas and Direct Reading Die Tables on the following types of dies: Bending and Forming Dies, Blanking Dies, Drawing Dies, Square and Rectangular, Drawn Shells, Miscellaneous Tables and Charts.

CUT OUT THIS AD TODAY!

Paste on card and enclose **$4.50** for single copy. $4.00 for six or more copies. Ten Days Free Examination.

DIE TECHNIQUES, Publishers

5005 W. LAKE STREET • CHICAGO 44, ILL.



Lightweight magnesium fixture checks Ford station wagons

This magnesium checking fixture is used by Ford Motor Company in assembling Ford two-door station wagons.

It helps to maintain quality by checking the daylight opening relationship to the glass run channel and regulator retainer brackets in the quarter panel welded assembly. It assures accurate location of the glass run retainers and window regulator mounting holes. The fixture is dimensionally stable and has stood up well under continuous rough handling. One man can easily lift and manipulate it with one hand.

Jigs and fixtures made with magnesium are always easy to handle because they weigh much less than steel or aluminum. Magnesium tooling plate is uniformly flat, low in cost and easy to machine, fabricate and weld.

For the full story on magnesium tooling plate contact your nearest supplier of Dow magnesium or write to us.

THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 1416U.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON DOW

now . . .

Carpenter e-x-t-e-n-d-s the built-in safety factor of STENTOR (oil-hard) tool and die steel!

Remarkable heat treating versatility found in no other oil-hardening, non-deforming tool steel, now assures extra cost-savings with Carpenter STENTOR (Oil-Hard). A broader, safe hardening range from 1425° F to 1525° F makes it possible to fit STENTOR tools and dies into many heat treating schedules during the average day.

Make your own evaluation. Add this extended built-in factor of safety to the other cost-saving advantages you get with STENTOR: easy machinability, less size change and distortion, uniform hardenability and freedom from decarb. Then call your local Carpenter Mill-Branch Warehouse, Office or Distributor for information and *rush delivery* on STENTOR with its extended built-in factor of safety.

Carpenter STEEL

matched tool and die steels

The Carpenter Steel Co., 154 W. Bern St., Reading, Pa.

Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

EVERY SUPPLY ITEM

Generally Used In Tool and Die Making

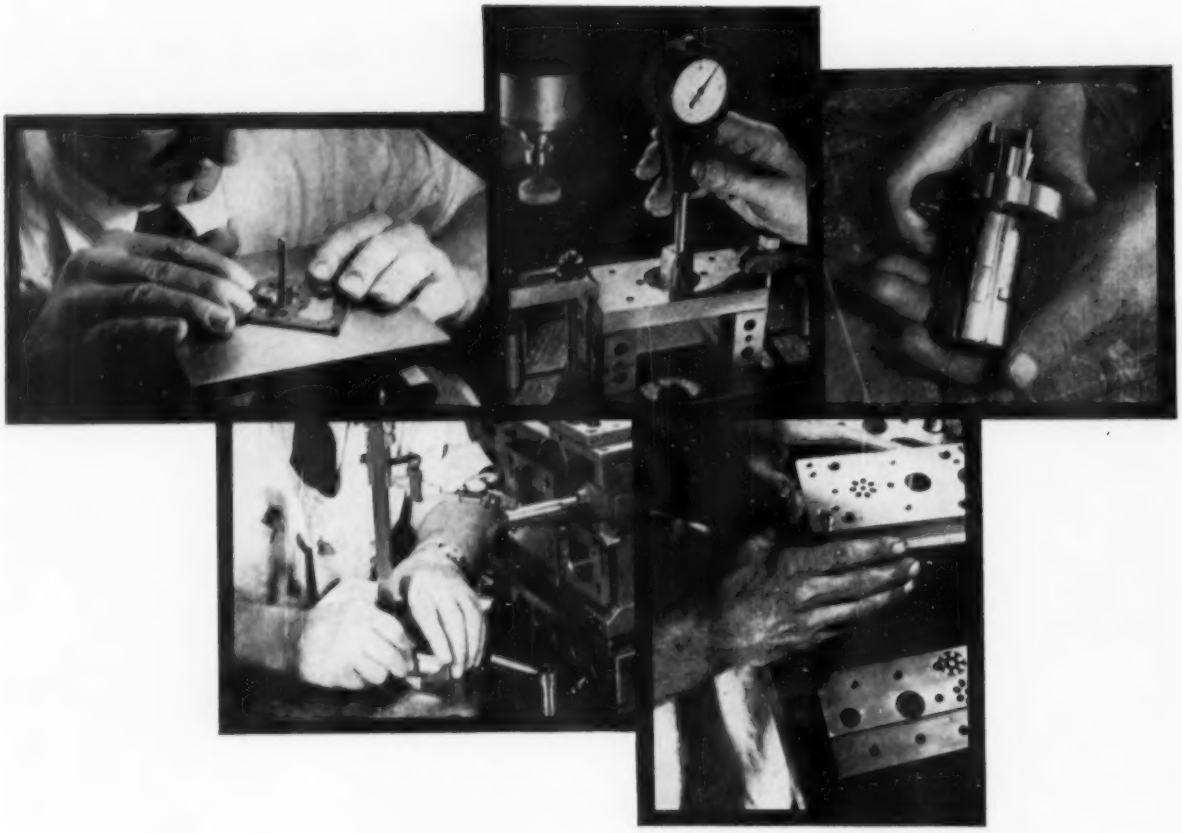
This drill team sets the pace in the tool, gage and die making industry. It's the most complete line of die makers' supplies available today . . . and it's available from stock at your Danly branch or leading industrial distributors everywhere. Danly's original line has kept in step with the industry to provide every new item for modern die making techniques. All items are manufactured to close tolerances and exacting performance standards in sizes to meet your needs.

DANLY®

Make your Danly distributor or branch assembly plant your source for fast delivery from stock.

DANLY MACHINE SPECIALTIES, INC. 2100 South Laramie Avenue • Chicago 50, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-293



THESE SKILLED HANDS

WILL NEVER BE REPLACED BY PUSH-BUTTONS

The sure hands of the tool and die craftsmen—and the creative industry they serve—will remain the key to mass production regardless of the extent to which automatic processes seem to take over.

All the special jigs, dies and other complex tools needed to mass-produce refrigerators or gunsights must be individually designed and built, no two alike.

America's independent contract tool and die plants had the ingenuity and initiative to tool up our military machine in amazingly short time during World War II and again in the Korean War. And today, these plants are contributing mightily to developments that will provide production improvements and economies.

In addition to its skilled hands, the contract tool and die industry offers an unmatched pool of specialized equipment, experience with a great variety of operations and materials, and supervision by individual, responsible owner-management.

More and more men in top management are insisting that their tooling problems be placed in the skilled hands of the tool and die plants—thus freeing their production executives to concentrate on production. If you are not yet among them, why not discuss your next tooling program with an NTDMA member. Write today for our new Directory of Member Plants and Services.

National Tool & Die Manufacturers Association
909 Public Square Building, Cleveland 13, Ohio

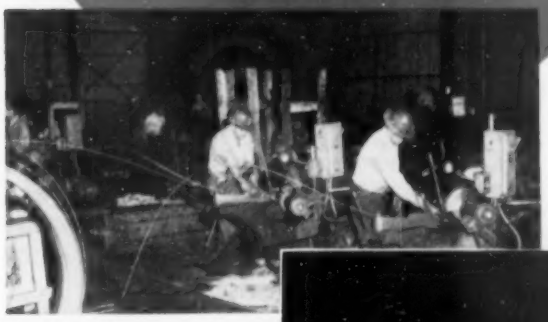
NATIONAL TOOL & DIE MANUFACTURERS ASSOCIATION — Tool & Die

IT PAYS TO GO OUTSIDE FOR SPECIAL TOOLING

BATH

Taps and Gages help to build the * World's longest suspension bridge!

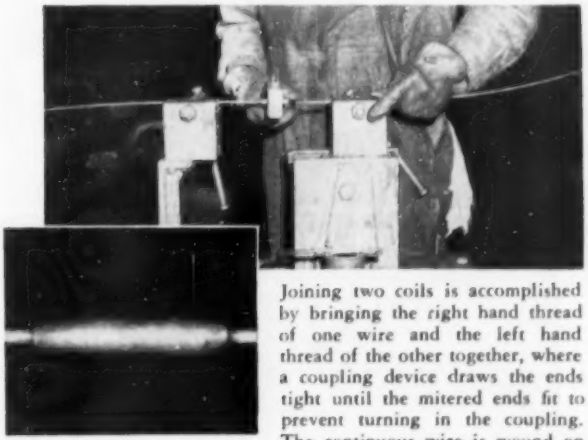
41,200 miles of wire suspends the Mackinac Bridge superstructure — constructed by American Bridge Division, United States Steel.



Each end of the coil of wire is fed to machines where one cuts a right and the other a left hand thread, both ends being mitered.

Photo-courtesy Contractors & Engineers magazine.

Right and left hand thread prior to splicing. Photo — courtesy Mackinac Bridge Authority.



The two ends are joined by a coupling. Photo — courtesy Mackinac Bridge Authority.

Joining two coils is accomplished by bringing the right hand thread of one wire and the left hand thread of the other together, where a coupling device draws the ends tight until the mitered ends fit to prevent turning in the coupling. The continuous wire is wound on huge reels for spinning equipment on the bridge . . . about 70 coils to a full reel of 16 tons (320,000 feet or over 60 miles of wire).

Photo — courtesy Contractors & Engineers magazine.

This majestic bridge represents a veritable monument to precision . . . with no detail too small for perfection.

The use of Bath special tools and dies to thread this wire for joining into strong, consecutive lengths of cable is proof of Bath engineering ability and high manufacturing standards.

Whether it's a small but important part of a big job — or a big part of a small job . . . you'll find Bath gages, taps and special tools are designed to guarantee controlled measure of component parts wherever accuracy is essential.

JOHN BATH & CO. Inc.
28 Grafton St., Worcester, Mass.

CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS
INTERNAL MICROMETERS

* INTERESTING FACTS

Wires per strand	340
Strands per cable	37
Number of cables	2
Total wires in each cable	12,580
Weight of superstructure	66,500 tons
Length of suspension bridge (including anchorages)	8,614 ft.

Time per component

3

seconds

CONTINUOUS MILLING

Milling flange faces of gas pump bodies at the Dunstable works of AC-Delco Ltd. Material—die-cast alloy, number on table—12. Time allowance—3 secs.

with

ADCOCK & SHIPLEY

Vertical Milling Machine

With Automatic 26″ Rotary Table

CUTS FLOOR-TO-FLOOR TIME—production milling time on many different components can be cut considerably with this versatile Model 2VR continuous vertical miller, with first-class finish and without strain on the operator.

Continuous milling cuts the unproductive waste out of floor-to-floor times. No time is lost in traversing or loading and unloading. The 2VR is milling all the time.

Write for a new leaflet showing how we have approached many typical cases. Let us see if we can do any of your jobs faster and better by continuous milling.

SALES, SERVICE AND PARTS AVAILABLE THROUGH AUTHORIZED DISTRIBUTORS

STANLEY SHEPPARD

U. S. Representatives • 30 Church St., New York 7, N. Y.

USE READER SERVICE CARD; INDICATE A-4-296-1

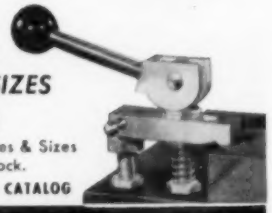
WESPO *for ALL* WORK-HOLDING *needs!*

TOGGLE CLAMPS
35 Types & Sizes

Note These Features—Reamed Holes—Hardened Serrated Bushings—High Tensile Strength Rivets

STANDARD FIXTURE CLAMPS

15 STYLES . . . 136 SIZES



COMPONENTS

Over 1000 different Types & Sizes available from stock.

Write **NEW TEMPLATE for CATALOG**

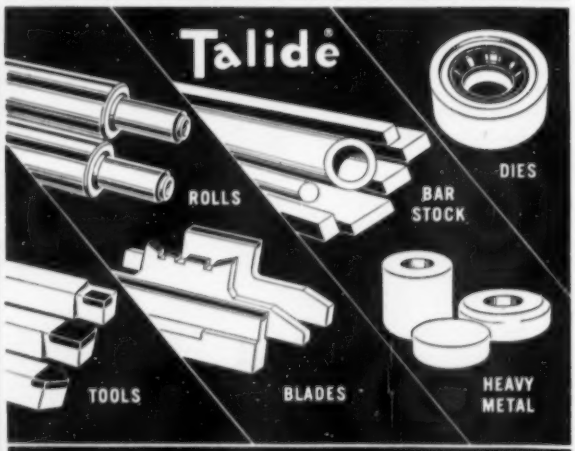
WEST POINT MFG. CO.

26939 W. 7 Mile Road • Detroit 19, Michigan

TWX—894

USE READER SERVICE CARD; INDICATE A-4-296-2

Talide®



HARDEST MAN-MADE METAL!

● New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 56-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 35 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

USE READER SERVICE CARD; INDICATE A-4-296-3

The only Belt Drive that
replaces uncertain friction grip with
POSITIVE
TOOTH ENGAGEMENT!

Gilmer
THE ORIGINAL
"TIMING" BELT
Power Transmission Drive

Just look at all the money-saving advantages that stem directly from this unique "Timing"® Belt feature:

There is no belt slippage or creep, therefore:
- Constant angular velocity is transmitted;
- Precision *timing* is maintained between shafts;
- Practically 100% efficiency is obtained;
- Belt and pulleys last much longer.

No initial belt tension is required, therefore:
- Belt's rated horsepower is all *working* horsepower;
- Bearing loads are minimized, and wear reduced;
- Take-up adjustments are eliminated.

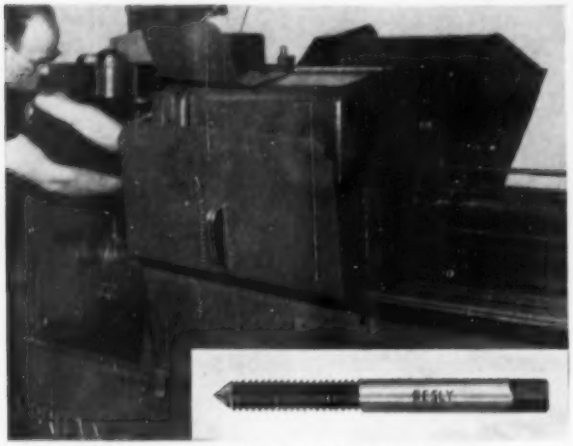
Less belt-pulley contact area is needed, therefore:
- Drives can be more compact, take less space;
- Smaller-diameter pulleys can be used;
- Higher drive ratios are practical.

Additionally, the "Timing" Belt drive needs no lubrication. Rating for rating, its cost is usually the lowest...especially when you can take advantage of stock drives.

A factory-trained Power Transmission Field Engineer will gladly help you adapt the "Timing" Belt's many unique advantages to your product's drives—from "fleapower" to over 1,000 horsepower!

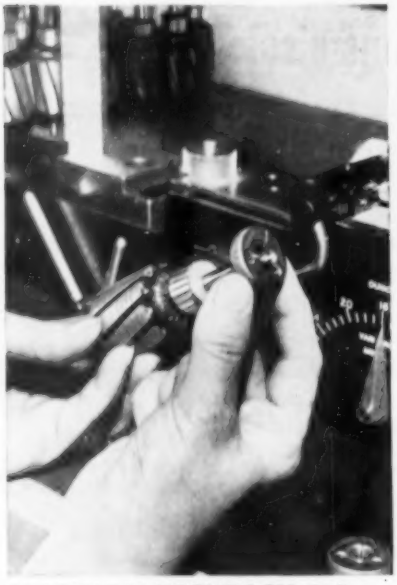
NYB&P
NEW YORK BELTING & PACKING CO. Founded 1846
NEW YORK BELTING & PACKING CO. 1 Market St., Passaic, N. J.
America's Oldest Manufacturer of Industrial Rubber Products

Cutting Tool and Gaging Methods . . . by BESLY



"ROLLING" THREADS IN COPPER—At Steel Industries, Inc., Crawfordsville, Ind., an automatic screw machine is being set up to size, bore and thread 1500 small, difficult-to-tap copper parts per hour. The Besly ¼-28" "X-Press" fluteless tap, shown, is used. H. M. Oshry, Vice-Pres., states, "Besly 'X-Press' Taps made it possible to use this high production method successfully. We get stronger, better, rolled (pressed, not cut) internal threads with no burrs or chips — longer tool life and fewer rejects."

MODIFIED TO FIT—The Gabriel Company, Cleveland, requires two concentric tapped holes in die-cast aluminum pistons used in their airplane type shock absorbers. Originally these were tapped individually — requiring 18 seconds per piece. To reduce this time, a unique set-up using Besly Taps was developed. A smaller Besly Tap is fitted inside the bored-out center of the larger Besly Tap. Two holes are now accurately tapped simultaneously in 9 seconds.



PRECISION ACCURACY—Bodine Electric Co., Chicago, uses Besly-Metro thread plug, thread ring, plain cylindrical plug and ring gages to assure precision accuracy of parts for electrical motor production. Asked why he uses them, A. Wermund, inspection foreman, says, "Last longer — sturdier built."

CARBIDE TOOLS IN ACTION—Cast steel truck wheels made by Gunnite Foundries Corp., Rockford, Illinois, are rough bored with a Besly BL-12-B5 Standard Carbide Tipped Tool, arrow 1, removing ⅛" to ⅜" of stock. On the same turret lathe a second Besly AL-12-B5 Standard Carbide Tipped Tool, arrow 2, semi-finish bores, removing .030" stock. Metal removal is at 200 S.F.M. at .016" feed. Besly's Engineering Service helped to achieve this efficient, low-cost metal removal set-up.

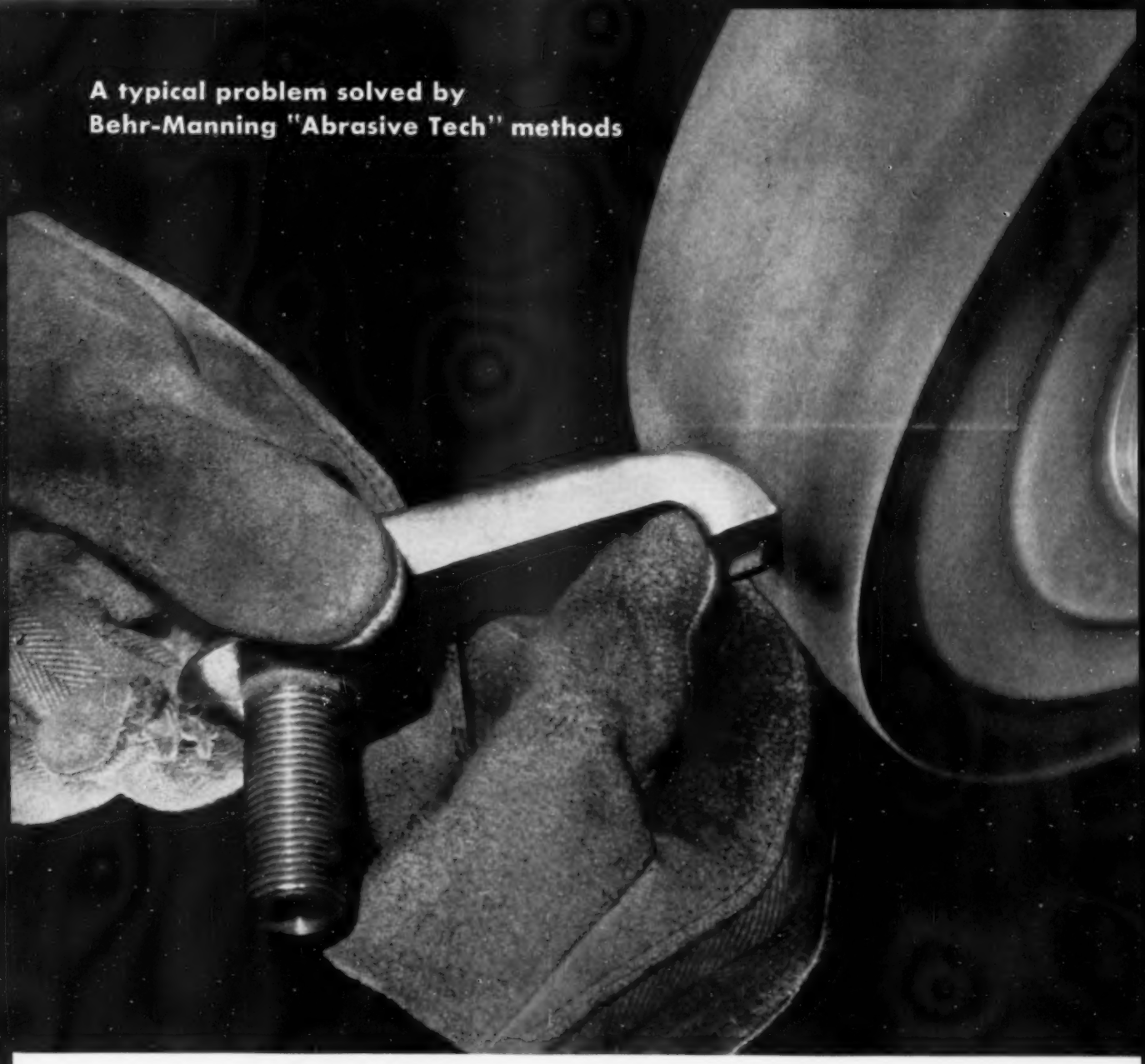
Prove to yourself that Besly Cutting Tools and Gages produce better results. Put them on trial on your toughest jobs, and check the difference in longer tool life, less down time, fewer rejects and faster production. If you'd like to try Besly tools or use Besly's Engineering Service, see your Besly distributor for details, or write us . . .

Engineering, Service and "Specials". . . are a Besly Specialty

BESLY

BESLY-WELLES
CORPORATION
Est. as C. H. Besly & Co. 1875
118 Dearborn Ave., South Beloit, Illinois

TAPS • DRILLS • REAMERS • END MILLS • TOOL BITS • GAGES
CARBIDE TIPPED TOOLS, BLANKS, TOSS-AWAY INSERTS and HOLDERS



8 steps in finishing were eliminated by using abrasive belts to rough and polish cast-brass faucets prior to plating. Polishing, for example, was faster and smoother with a 3-in. x 90-in. Lightning Metalite Cloth belt, grit 240, running at 9000 sfpm over a 14-in. stitched buff contact roll on a Crown Rheostat Polishing Lathe. The belt is lubricated with a light grease stick. Time, labor, and material costs have all been cut by this "Abrasive Tech" method. Perhaps Behr-Manning technical service may provide similar benefits for your production.

Very often a Behr-Manning methods engineer can provide a helping hand with different finishing problems. Just call the nearest Behr-Manning office for a date. There are 17 well-equipped "Abrasive Tech" Methods Rooms, available for problem-solving, or helping finishers brush up on new techniques: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, Teterboro, Camden, San Francisco, Seattle, St. Louis, and Brantford, Canada. Main office and plant: Troy, N. Y. For Export: Norton Behr-Manning Overseas, Inc., New Rochelle, N. Y., U.S.A.

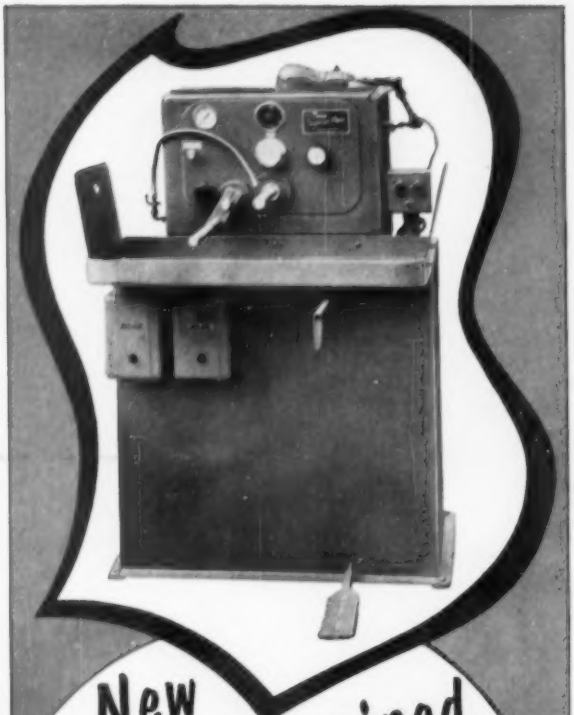
BEHR-MANNING CO.

A DIVISION OF NORTON COMPANY

NORTON ABRASIVES

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING ®



New Heights Attained in Honing Perfection

SUPERIOR MODEL H. M. HONEMASTER

- The right speed (infinitely variable 250 to 1150 r.p.m.) and correct stone pressure (fully adjustable) makes for better work of any diameter, finish or material.
- Hydraulic system assures constant pressure with no fall off due to stone wear or stock removal . . . constant cutting action always.
- Single control dial shows when first piece is coming to finish size. Set, then compensate only for stone wear thereafter.
- Hydraulic clutch and brake.
- Foot and knee operation pedals.

Stocked in all Principal Cities

SUPERIOR HONE CORPORATION

1612 Elreno Street • Elkhart, Indiana

Please send full details and prices on the Honemaster.

NAME _____

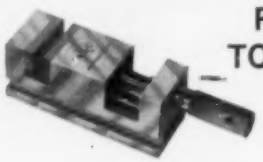
FIRM _____

STREET _____

CITY & STATE _____

NAME OF SUPPLIER _____

USE READER SERVICE CARD; INDICATE A-4-300-1



PRECISION TOOLMAKERS' VISE

FEATURES:

(1) Precision ground on all external surfaces to a maximum permissible error for squareness of .0004" per inch. Not cumulative!

(2) Dovetailed slide giving rigidity and parallel location of jaws under all circumstances.

(3) Slide adjustable for wear by six socket headed screws in base allowing maintenance of parallel slide.

(4) Hardened and ground jaws can be removed for replacement with special jaws or for reconditioning.

(5) Totally enclosed screw. Grit or dust cannot get into the leadscrew.

(6) Screw operated by knurled handle or bar.

(7) Dust-proof means of oiling leadscrew, provided by screw in end of handle.

(8) ALL PARTS HARDENED, except leadscrew which is made of High Tensile Steel for long wear.

(9) Groove provided all round base provides means of clamping vise to machine tables, etc.

	CAPACITY			PRICES		
	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
Width of Jaw	1¼"	1⅞"	2½"			
Depth of Jaw	7/16"	11/16"	15/16"			
Jaw Opening	1"	1½"	2"			
Weight lbs.	1¼	4⅛	10	$24.50	$38.75	$67.50

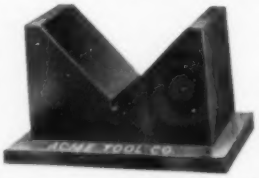
AIR TRANSPORT EQUIPMENT, INC.

ALBANY AVENUE, AMITYVILLE, NEW YORK - Tel. AMityville 4-5300

USE READER SERVICE CARD; INDICATE A-4-300-2

SEMI-PRECISION "V" BLOCKS

FOR ALL-AROUND SHOP USE



Stock No.	Base	Capacity	Net Price Ea.
10	4½"x3"	2¾" Dia.	$ 8.00
11	6½"x4"	4¾" Dia.	16.25

Sturdily designed for hard usage . . . ideal for drill presses, milling machines, shapers and planers. Will test round shafting for straightness . . . Made from "Tenzaloy" (Aluminum Alloy).

WRITE FOR DESCRIPTIVE BULLETIN

ACME TOOL COMPANY

71 West Broadway New York 7, N. Y.

USE READER SERVICE CARD; INDICATE A-4-300-3

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

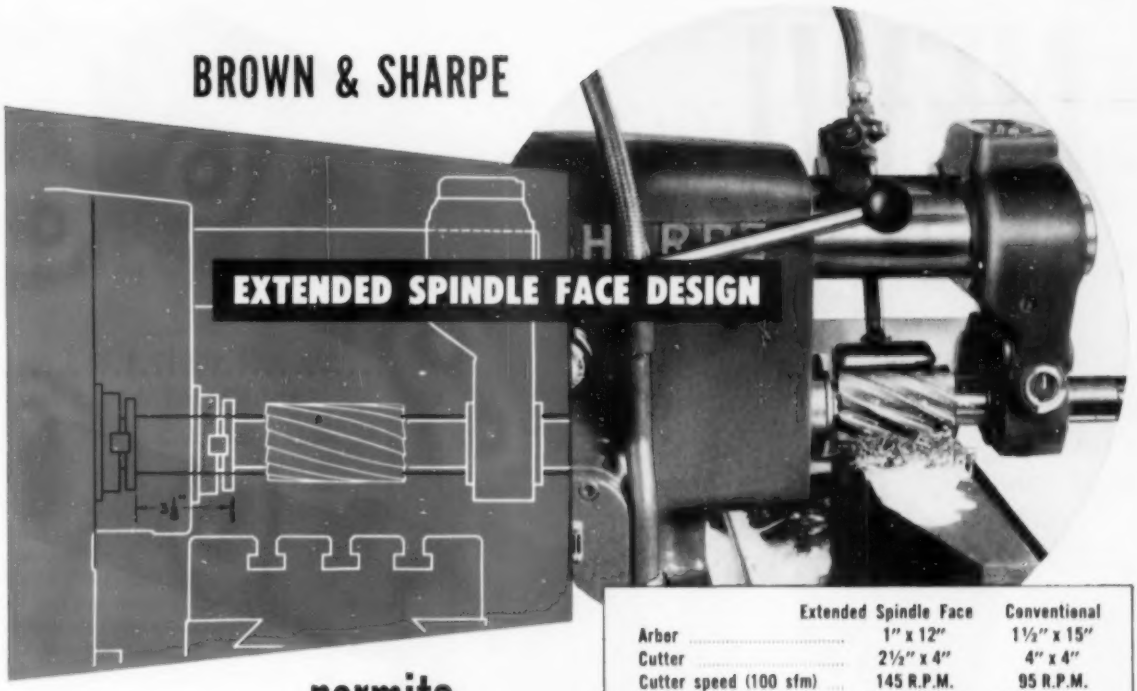
Write for sample on company letterhead

THE DYKEM COMPANY

2303D North 11th St. • St. Louis 6, Mo.

USE READER SERVICE CARD; INDICATE A-4-300-4

BROWN & SHARPE



	Extended Spindle Face	Conventional
Arbor	1" x 12"	1½" x 15"
Cutter	2½" x 4"	4" x 4"
Cutter speed (100 sfm)	145 R.P.M.	95 R.P.M.
Feed (.047" per rev.)	6¾" per min.	4½" per min.

permits

30% SAVING

in cutting tool expense

A simple feature at first glance, the extended spindle face of Brown & Sharpe Universal and Plain Milling Machines is the source of multiple savings in milling costs. As the diagram shows, this exclusive design brings the spindle nose support over 3" closer to the cutting point, providing greatly increased rigidity and resistance to vibration.

PLUS – 50% FASTER PRODUCTION

In the set-up illustrated, the use of smaller diameter cutters permitted an increase in RPM at the given surface speed. Feed rate was increased proportionately, providing 50% faster production with the same surface quality. The extended spindle face is one of many examples of economy-minded design found only in Brown & Sharpe Milling Machines. Get full information . . . compare. You'll find there is no better investment — by any test. Write: Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

You save with . . .

SMALLER DIAMETER ARBORS

Because of shorter span between supports, a shorter, smaller diameter arbor can be used, with deflection resistance equal to that of 50% larger diameter arbor on conventional machine.

REDUCES ARBOR COSTS

SMALLER DIAMETER CUTTERS

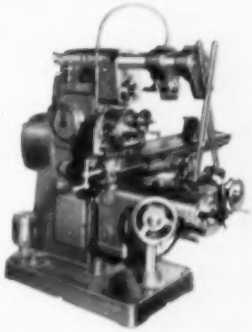
Because of reduced arbor diameter, in the example illustrated a 2½" x 4" cutter with 1" hole replaces the 4" x 4" cutter with 1½" hole required on a conventional machine.

REDUCES CUTTER INVESTMENT

EXTENDED CUTTER LIFE

Extra support and increased rigidity minimizes vibration. Cutters run longer before resharpening. Downtime is reduced.

SAVES MAINTENANCE COSTS



No. 2 UNIVERSAL Milling Machines 3 and 5 HP Spindle Drive

No. 2 PLAIN Milling Machines 3 and 5 HP Spindle Drive

Brown & Sharpe

MILLING, GRINDING, AND SCREW MACHINES, CUTTERS, MACHINE TOOL ACCESSORIES, PRECISION TOOLS, PUMPS

NEW!

KENNAMATIC TOOL

incorporates Kendex* Chip control features

- **provides uniform chip control**
- **eliminates chipbreaker grinding**
- **allows you to use up short inserts**

This new tool utilizes the simple, effective and economical Kendex chip control system while retaining the best of the time-tested Kennamatic tool features.

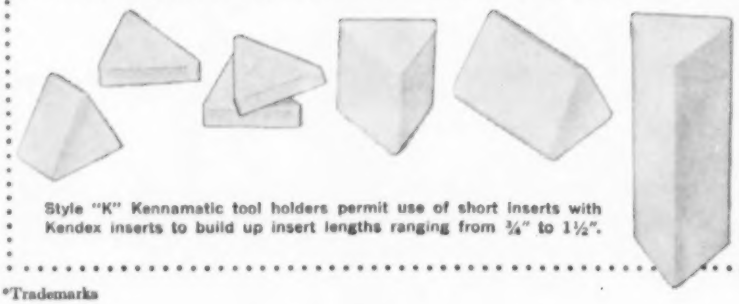
It has the Kendex top structure with its clamped Kennametal* chipbreaker plate. This provides uniform chip control over a wide range of feeds and depths of cut. It also eliminates costly grinding of chipbreakers.

A milled shoulder or ledge on the top of the holder is located adjacent to the cutting edge. This serves as a "height gage" for accurate and fast relocation of the insert cutting point on center line of workpiece. Machine downtime for insert changing is thus held to a minimum.

The broached insert pocket and back-up screw, which has a ¾" adjustment, makes it possible to use any combination of inserts to form a total insert length ranging from ¾" to 1½". Short inserts may be stacked or combined with Kendex inserts. This permits use of more of the original insert, and simplifies insert inventories if you are converting from long inserts to "throw-aways."

Style "K" Kennamatic tool holders are available from stock in 7 styles and a wide range of shank sizes, plus a full complement of Kennamatic inserts, for a wide variety of machining operations.

Your Kennametal tool engineer will gladly demonstrate the new Kennamatic Tool. Call him or write to KENNAMETAL INC., Latrobe, Pa.



Style "K" Kennamatic tool holders permit use of short inserts with Kendex inserts to build up insert lengths ranging from ¾" to 1½".

*Trademarks

INDUSTRY AND
KENNAMETAL
...Partners in Progress

Progress Report:

SCHRADER AIR PRODUCTS CAN MAKE PRECISION OPERATIONS EFFICIENT

● Let's clear the air about close tolerances

We've faced it. Lots of manufacturers still think air is as unpredictable as the weather report. But others know better, because they've taken the time to let a little sunlight on the subject. These open-minded ones are utilizing Schrader Air Products, not just to hold work or blow away chips, but to produce complex units to close tolerances.

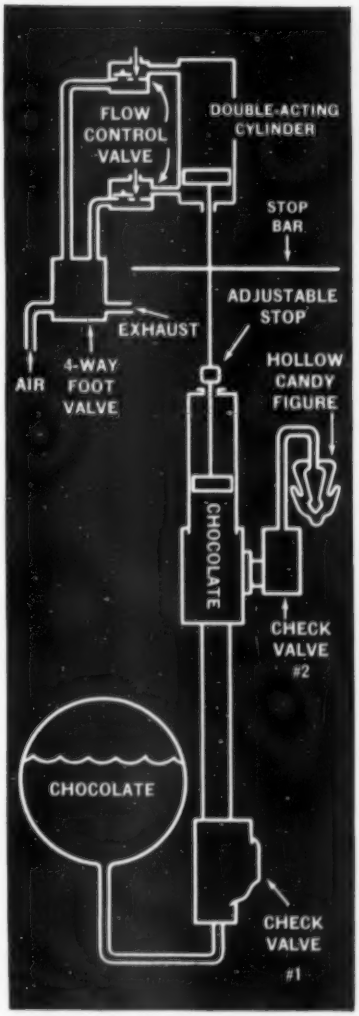
Air is a big boy now. It has grown up fast because automation came because pennies needed pinching. Because many operations in manufacturing turned out to be just plain dangerous. Then engineers found air was not only efficient, economical, and safe, but that products were already designed and produced to make air a logical way of performing hundreds of special jobs.

FOR EXAMPLE:

● Sweet words about air from a candy maker

At a Buffalo, New York, candy company, Schrader Air Products have been used to perform a complex measuring operation. To within one gram! Six Schrader double-acting cylinders are used to fill a bank of six more single-acting cylinders with a prescribed amount of chocolate. When a foot valve is released, the chocolate is forced into wax figurines, exactly filling them. And the entire installation is even covered and kept at a constant temperature to insure the proper chocolate viscosity.

Take a look at the schematic. It shows the arrangement by which the Schrader Air Products are adapted to an operation which might at first seem far outside the limits of air use. It was possible because some engineers put on their thinking caps.



Schematic shows how Schrader Air Products are adapted for precision handling of liquid chocolate.

● Talk about air's advantages being automatic—lend an ear

This is important to you, so don't wander off. When air is used to synchronize motions automatically, efficiency is almost sure to follow. BUT, the natural advantages of air multiply like rabbits. For instance, economy is basic. In many cases it can make the difference between profit and loss. Then, safety margins are widened by the use of special control techniques. Air's simplicity makes possible easy finger-tip and tip-toe operation of tiring hand and foot movements. Fatigue? Who's tired? Production goes up. Modern packaged control sets are so highly developed that most hazards of press operation are no longer applicable. Both hands must be used at once, and cannot stray into danger zones. Any machine using a mechanical clutch, shears, brakes and friction clutches can use special controls.

● We <u>like</u> to be taken advantage of

You can make use of Schrader's engineering facilities. That's why we *have* them. Upon request, Schrader engineers will assist in planning for the most efficient use of air in your plant, and in selecting the products best suited to a given application. Distributors are conveniently located to deliver Schrader Products in the shortest possible time.

Write to Schrader for information. Address A. Schrader's Son, Division of Scovill Manufacturing Company, Incorporated, **462** Vanderbilt Avenue, Brooklyn 38, N. Y.

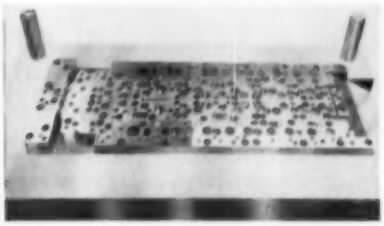
Schrader®
ESTABLISHED IN 1844

FIRST NAME IN THE USE OF AIR
FOR INDUSTRIAL PRODUCTION AND CONTROL

Holes

JIG GROUND with *Vulcanaire*

Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



41ST year of Vulcan service.

A seven station die from Vulcan's contract Tool Room. Standard sized punches and buttons were used. But since forming and piercing operations were involved hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

Borrow our instructive 11 minute movie on Jig Grinding.

A five station indexing fixture from Vulcan's contract Tool Room. Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts, and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

Services of YOUR TOOL ROOM in Dayton

Engineering, Processing, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

VULCAN TOOL CO.

7300 LORAIN • DAYTON 10, OHIO

USE READER SERVICE CARD; INDICATE A-4-304-1

VAILL

TUBE END-FORMING MACHINES

shape and form tube ends

fast... accurate... at less cost

FREE — New Bulletin T-1 shows, describes VAILL tube end forming machine VERSATILITY for . . .

Beading • Flaring • Flanging • Sinking

Expanding • Grooving • Threading • Reducing

Double Lap Flaring • Double Lap Flanging

on Tubing up to 6" Diam.

THE VAILL ENGINEERING CO.

131 E. MAIN STREET WATERBURY 20, CONN.

USE READER SERVICE CARD; INDICATE A-4-304-2

PRECISION GEARS?

ROLL TEST THEM RAPIDLY ACCURATELY with the

SCHERR

5" CENTER DISTANCE FINE PITCH GEAR TESTER

Fine Pitch Precision Gears are quickly tested for runout of Pitch Diameter, Spacing and Tooth Form Errors.

Scale Vernier: .0005" Indicator Readings

The New Model is equipped with adjustment of measuring pressure from 4 ounces to 2 pounds

OTHER SIZES OF GEAR TESTERS AVAILABLE UP TO 30".

Send for Illustrated Folder - Code GIKNA

GEORGE SCHERR CO., Inc.

COMPLETE LINE OF PRECISION INSTRUMENTS

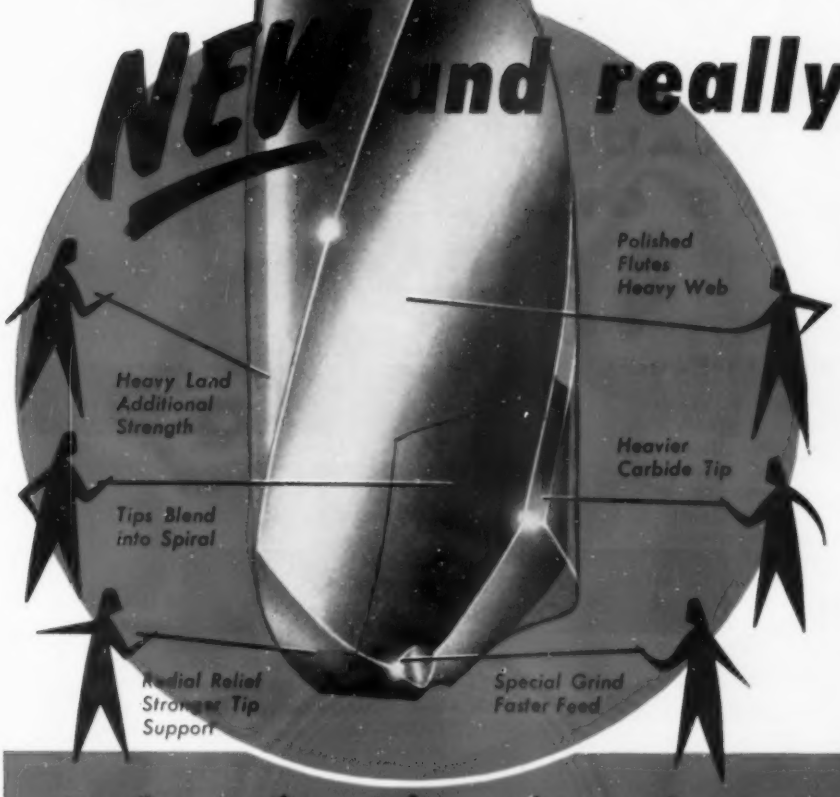
200-TE LAFAYETTE STREET • NEW YORK 12, N.Y.

USE READER SERVICE CARD; INDICATE A-4-304-3

STC

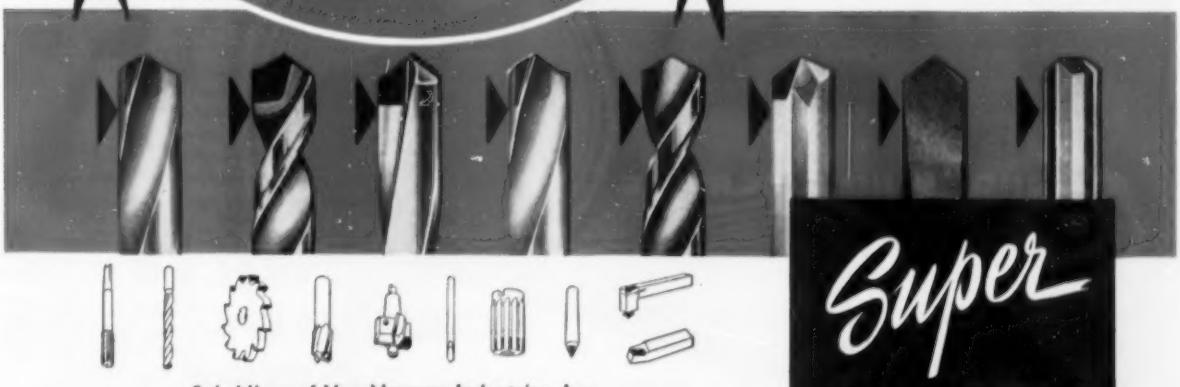
For Every Carbide Drilling Application There's a STANDARD SUPER DRILL

NEW and really super!



Six points of superiority— Result of two years' research. Extensive tests indicate it's the most durable and the fastest cutting carbide twist drill developed to date. Feeds as high as 8" per minute in cast iron have been obtained. Stocked in fractional, wire and letter sizes for your convenience.

NEW LOW PRICES
Write to Dept. 328 for New Catalog No. 56



Subsidiary of Van Norman Industries, Inc.

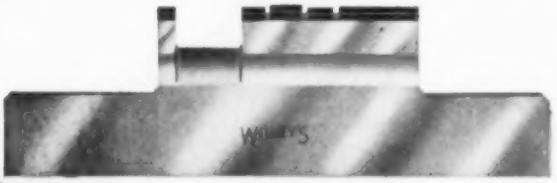
Super TOOL COMPANY

21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Los Angeles 3, California

WILLEY'S CARBIDE WORK SUPPORT BLADES FOR CENTERLESS GRINDERS

FROM STOCK standards & specials

Thru-Feed • In-Feed • Long-Bar
Tube & Rod • Roller In-Feed
Race • Power Race
Heavy Duty



WORK SUPPORT BLADES

for special application

Willey's have pioneered in the development and manufacture of carbide work support blades. Seasoned toolmakers with "know-how" build these tools for standard as well as for special applications. Many centerless grinding operations require special carbide tipped work support blades for work such as: multi-diameter—angular—form—tapered or radius grinding.

Write for complete illustrated catalog and price list

RECONDITIONING SERVICE

Willey's regrind or carbide re-tip your worn out, chipped, broken or damaged work support blades to original accuracy . . . smooth—straight and parallel. For more than 20 years Willey's customers have used this service, often having the same blade reconditioned many times . . . a service and savings available to you too.

WILLEY'S CARBIDE TOOL COMPANY

1340 WEST VERNOR HIGHWAY • DETROIT 1, MICHIGAN
WOodward 1-9444

"A" Grade Working Gage Blocks . . . at "B" Grade Prices

Set No. 860*
84 pieces
.0001" Series— 9 Blocks .1001" thru .1009"
.001" Series—49 Blocks .101" thru .149"
.050" Series—19 Blocks .050" thru .950"
1.000" Series— 4 Blocks 1.000" thru 4.000"
Quarter tenth Series—3 Blocks .100025", .100050" .100075"

Set No. 380*
36 pieces
.0001" Series—9 Blocks .1001" thru .1009"
.001" Series—9 Blocks .101" thru .109"
.010" Series—9 Blocks .110" thru .190"
.100" Series—5 Blocks .100" thru .500"
1.000" Series—3 Blocks 1.000" 2.000" 4.000"
Half tenth Series—1 Block .10005"

* .050" or .100" steel or carbide wear blocks available at slight extra cost.

NEW DoALL SHOP-BLOCKS

ACCURACY:	+ .000006" − .000002"
FINISH:	0.8 AA or better
FLATNESS:	.000004"
PARALLELISM:	.000004"
HARDNESS:	65 Rc

. . . Superior Accuracy for Shop Measurements

No shop can afford to rely on less than Bureau of Standards A Grade gage block accuracy to maintain adequate Dimensional Control by Today's Standards. This accuracy is possible, practical and *here now*, at a price *any* shop can afford. The new low priced DoALL Shop Blocks are guaranteed equal to Bureau of Standards A Grade specifications.

Check the prices, compare the specifications with any other "working" gage blocks. Nowhere else will you find genuine A Grade blocks priced for shop use.

DoALL SHOP BLOCKS meet the realities of today's precision tolerances required right at the bench, job or machine. They represent DoALL's decision to completely discontinue manufacture of B grade blocks, as inadequate for today's dimensional control needs. They provide working accuracies that will save you valuable time, effort and waste . . . give better control needed for shop measurements.

Your DoALL Store is taking orders now for the new SHOP BLOCKS. Call DoALL today. Learn more about these new gage blocks that insure unprecedented working accuracies at a price unmatched anywhere—only DoALL offers you A Grade SHOP BLOCKS at less than B Grade prices!

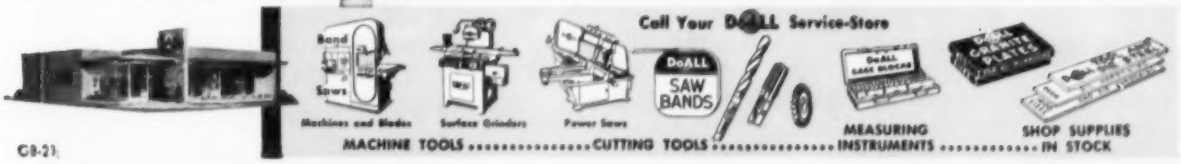
Better Blocks for Inspection and Laboratory, Too!

New DoALL blocks for inspection and lab use having surface finish of 0 to 0.09 AA are made in A + and AA grade accuracies. For ultra precision work DoALL offers AAA grade accurate to one millionth of an inch. ASK FOR CATALOG.

Your DoALL Store is headquarters for the best in measuring instruments

ASK FOR LITERATURE
. . . call DoALL or write:

DoALL The DoALL Company
Des Plaines, Illinois



CB-21

STUPALOX

Sintered Oxide

CUTTING TOOLS

OUTPERFORM OTHER CUTTING TOOLS TWO TO TEN TIMES!

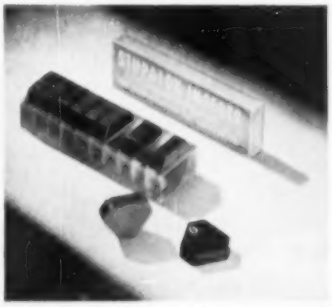
Deeper cuts, faster speeds, greater hourly production, machining the "unmachinable"—these are typical results discovered in scores of tests of STUPALOX versus other cutting tool materials.

Comparative performance studies of various tools in production shops, under normal operating conditions, brought out the relative abilities of each material. In these tests, STUPALOX outperformed other tools TWO TO TEN TIMES! In many cases, the full potentialities of STUPALOX could not be realized because of the limitations of power, or the rigidity of the machines in which the tests were performed.

As a direct result of these tests, a number of companies have already standardized on Stupalox tools, with gratifying improvements in machining costs and production.

Stupalox tools are available in several styles and sizes of inserts, and in commercial quantities. We will be glad to send you specific information on experiences with Stupalox for machining a wide variety of ferrous and non-ferrous metals.

HANDY PACKAGE...
This compact plastic box contains ten Stupalox sintered oxide tool inserts.



STUPAKOFF DIVISION OF
The CARBORUNDUM Company
WRITE DEPT. TE LATROBE, PENNSYLVANIA

USE READER SERVICE CARD; INDICATE A-4-308-1

This IS THE WAY TO SHORTEN SET-UP TIME

Types to fit any machine used for tapping or reaming.

Set-ups for tapping and reaming can be made in a fraction of the time usually required if you take one simple precaution --provide yourself with a Ziegler Floating Tool Holder.

This is because, with the Ziegler, the set-up does not have to be made with the same degree of accuracy as is necessary when an ordinary tool holder is used. Just come within 1/32" of center on the radius (or 1/16" on the diameter) and the Ziegler automatically compensates for the inaccuracy.

Shorten set-up time from now on by always using Ziegler Floating Tool Holders!

PROMPT DELIVERY

W. M. ZIEGLER TOOL COMPANY
13574 AUBURN DETROIT 23, MICH.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-4-308-2

AIR HAMMER
With Metering Trigger

Delivers 0 to 13,000 Controllable Blows Per Minute

Weighs only 20 oz. Measures Just 6" Long.

Bantam Bully Air Hammer has Superior's exclusive metering trigger—delivers anywhere from 0 to 13,000 completely controllable blows per minute. Uses only 6.5 cu. feet of air per minute at 90 P.S.I.

24 DIFFERENT TOOLS FOR

- Scaling
- Chiseling
- Peening
- Tamping
- Sheet Metal Cutting
- Paint Scaling
- Routing
- Caulking
- Pin and Key Driving
- Star Drilling
- Fender & Body Work
- Cleaning Molds

NEW HANDY SLIP CHUCK

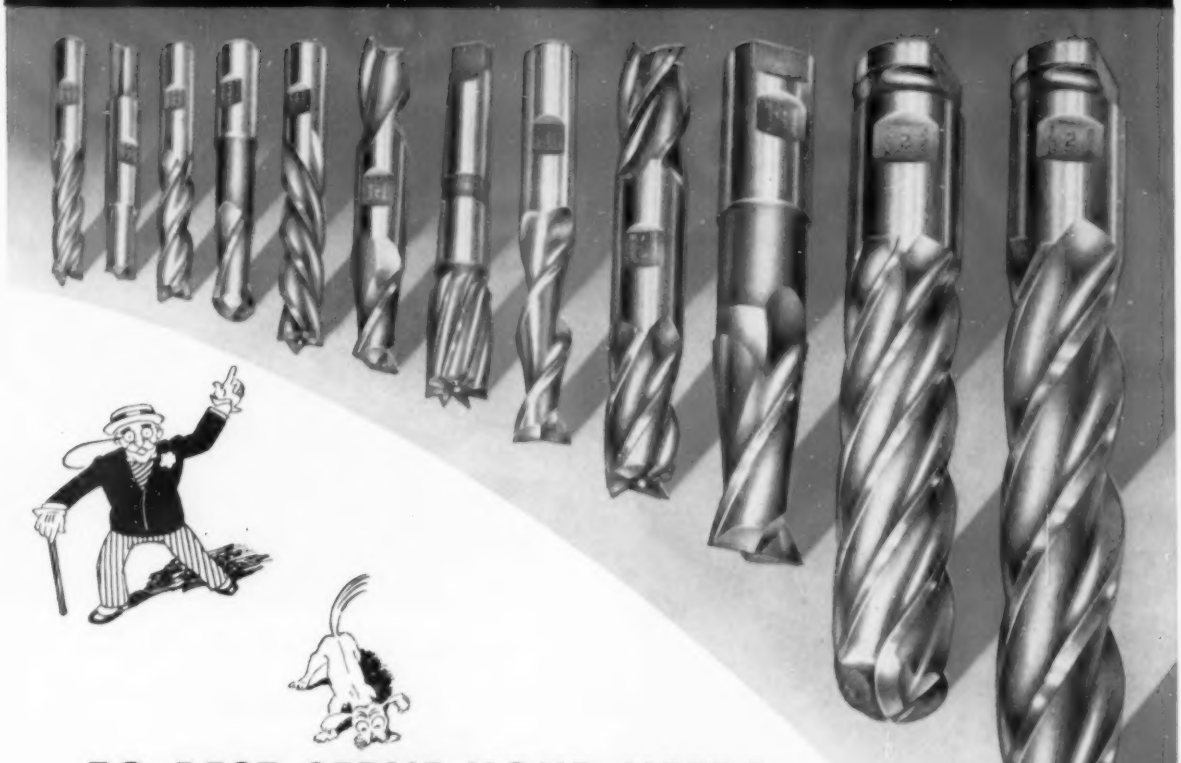
Tools are positively locked, snap in or out easily; can be locked in 8 different positions.

Write Dept. T-4.

SUPERIOR PNEUMATIC & MANUFACTURING, INC.
4758 Warner Road **Cleveland 25, Ohio**

USE READER SERVICE CARD; INDICATE A-4-308-3

END MILLS ARE OUR BUSINESS . . .
NOT A SIDELINE



TO BEST SERVE YOUR NEEDS

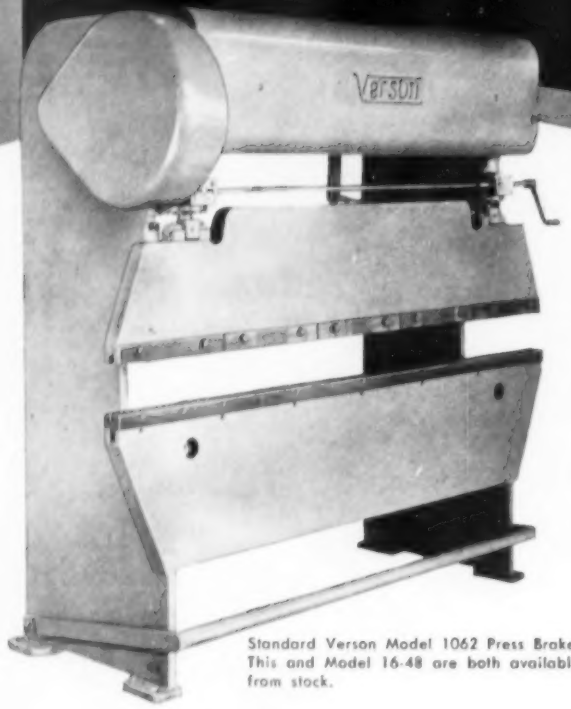
For over twenty years our designing and manufacturing abilities have been devoted to producing highest quality end mills. Because end mills are our business, we realize that universal acceptance of our product is obtained and maintained by continuously supplying the best end mills available.

Putnam manufactures and stocks over 1400 standard types and sizes of end mills. Thus, you can quickly and economically select the exact size and type to best meet your needs.

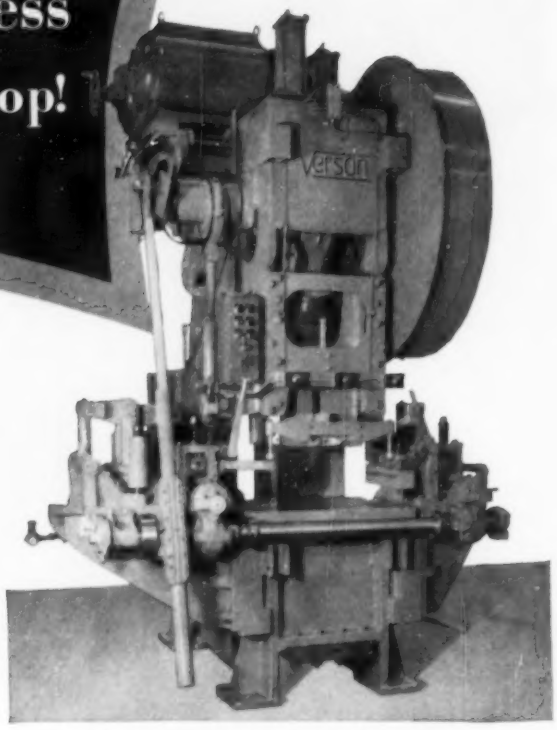
Putnam Distributors from Coast-to-Coast carry large stocks of standard end mills. Contact your neighbor, the local Putnam Distributor, he will recommend the best end mill for specific jobs, give you personalized service, and quickly supply your needs with the finest end mills obtainable.

PUTNAM
TOOL COMPANY
2981 CHARLEVOIX AVENUE · DETROIT 7, MICHIGAN

There is a Verson Press that belongs in *your* shop!



Standard Verson Model 1062 Press Brake. This and Model 16-48 are both available from stock.



Standard Verson No. 7½ upright open back press with automatic roll feed and straightener.

Efficient

Verson Press Brakes

There is a Verson Press Brake to meet every requirement for forming, bending, coping, notching or punching. Starting at 15 tons capacity, six basic lines are available—Standards, Juniors, Intermediates, 300 Series, Majors and Hydraulics. All represent the ultimate in press design and are built to the highest standards for strength, rigidity, endurance, accuracy and power.

Verson Press Brakes' many exclusive features mean help to your shop in producing more of better products at lower cost. Write today and ask a Verson engineer to recommend the model best suited to your operation.

Versatile

Verson O. B. I. Models

Liberal slide and bed area, stroke length and depth of throat make Verson O.B.I.'s ideal for a wide variety of jobs in shops of all types. Combining big press standards of design, construction and operation, Verson O.B.I.'s provide the accuracy and overall production economy normally associated only with large, costly machines.

Six Verson O.B.I. models range in capacity from 90 to 250 tons. Verson engineers will be pleased to assist you in selecting an O.B.I. to meet your shop requirements.

Verson Allsteel Press Company manufactures virtually every type of press. With this background we can recommend the type Verson press that will best meet your needs. Write today outlining your requirements.

A Verson Press for every job from 60 tons up.

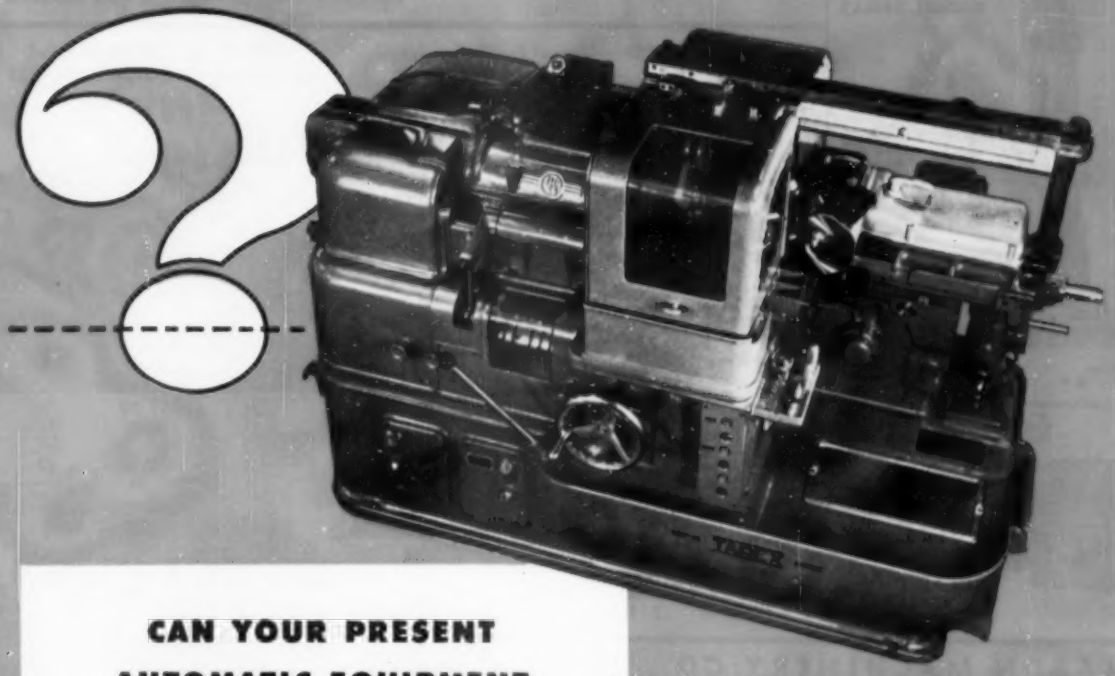
Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9336 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • 8300 S. CENTRAL EXPRESSWAY, DALLAS, TEXAS

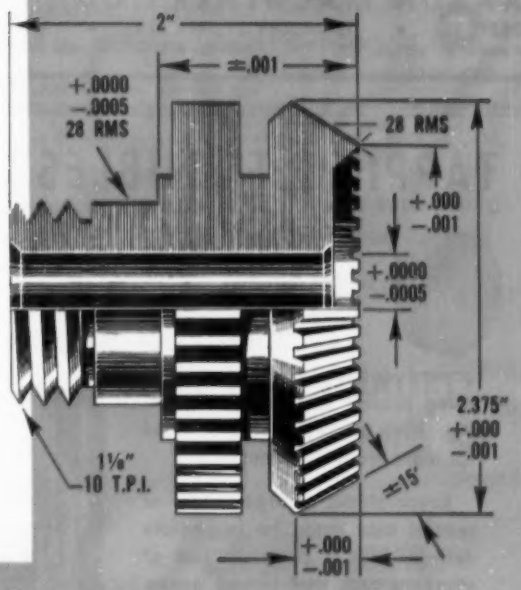
MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES



CAN YOUR PRESENT AUTOMATIC EQUIPMENT *make this* BEVEL CLUSTER GEAR *complete* FROM BAR STOCK *in one operation* READY FOR GEAR CUTTING?

...it can be done on the

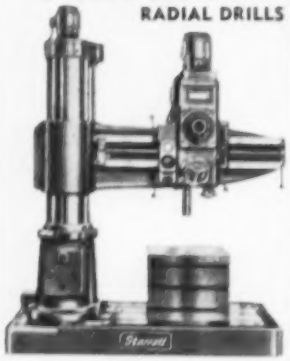
TAREX



RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

BEST VALUES in U.S.A.
STARRETT
RADIAL DRILLS

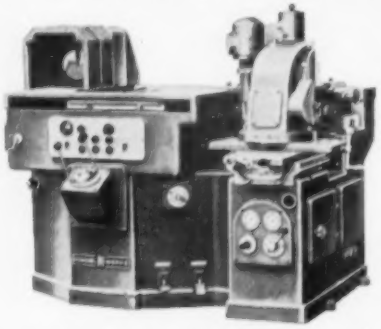


Sizes 2½" to 6' $1785. to $6985

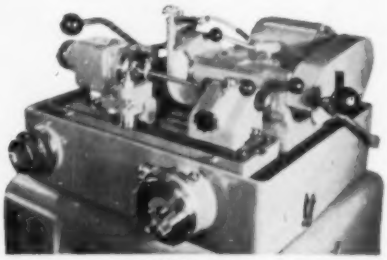
Outstanding New Machinery at low cost!

$1. BUYS ANY MACHINE
Upon Termination of 3 Year Rental Plan.

HOMMEL—OPSM—Optical Profile Grinder

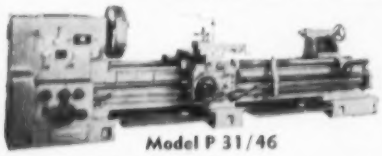


OVERBECK—EXTERNAL and INTERNAL PRECISION GRINDERS



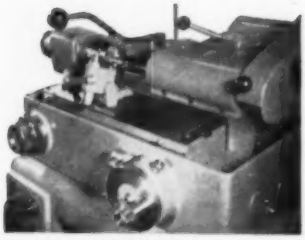
$2995.00

IMPERIAL LATHES—FLAME HARDENED AND GROUND BED WAYS



Model P 31/46
$8,890.

Model PS-34/61
$12,990.
Swing from 12" to 67" available
Sliding bed gap lathe



$3195.00

AARON MACHINERY CO., INC.
DEPT. Y. • 45 CROSBY ST., N.Y. 12 • WA 5-8300
Branches at: Buffalo, N.Y. Mineola, N.Y. Los Angeles, Calif.

Liberal Terms

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-312-1

TAPPING TROUBLES?

Royco Precision Ground Taps are engineered for your particular job.

Royco Taps are ground entirely between centers using precise machines and tooling. High quality is not sacrificed for mass production methods.

Royco stocks a large supply of special taps ready for immediate delivery plus a complete line of standard taps and thread gages. All types are ground — including acme, square thread, buttress etc.

Send for catalog today.

Royco Service Will Save You Money

Royco Tap & Tool Corp.
PHONE 2210
BOX 2688 NORTH BRANCH, MICH.

ASTE DATA SHEETS

USE READER SERVICE CARD; INDICATE A-4-312-2

Are you prepared . . . to gage precision holes to fractions of .0001" IN VOLUME "anywhere, any time, by anybody"

Shift Comtorplug around anywhere: machine, bench, laboratory, on a minute's notice. Anybody can use it with precision, because of built-in positive accuracy. No wires, no air hose, no heavy base, no electronic gear. Same amplifier head fits all size plugs: ⅛" to 10" dia. Fixed reading — not passing — shows ACTUAL SIZE front or back taper, ovality, etc.

PRECISION INTERNAL GAGE
Sizes from ⅛" to 10" and larger

COMTORPLUG
Used by the thousands in jet propulsion, aircraft, automotive, household appliance and other volume-precision applications. INVESTIGATE!

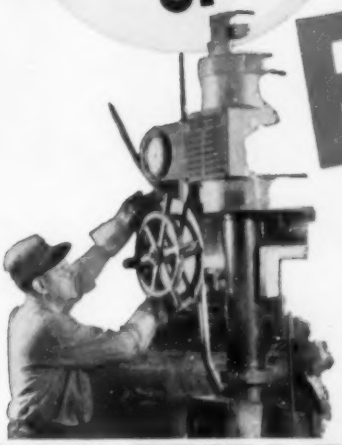
COMTOR CO.
69 Farwell St., Waltham 54, Mass.

Request New Bulletin 50

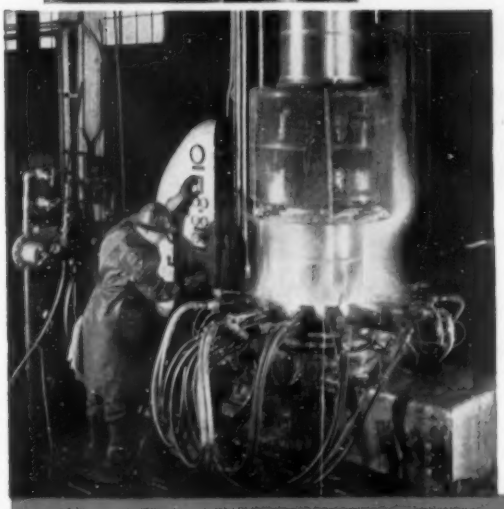
USE READER SERVICE CARD; INDICATE A-4-312-3

YOU CAN'T BEAT THE COMBINATION OF

SKILLS and EQUIPMENT



...which ONLY the Commercial Heat Treater can provide



Today's modern commercial heat treating plant might well be described as a "department store" for metal treating services. For under one roof are offered you not only the full range of heat treating equipment for all types of processes . . . but . . . of still greater importance, the manpower skills of the management and technicians of those supervising and performing your jobs. *Service* is their keynote.

Whatever your needs . . . whenever you need it . . .

● CONSULT YOUR COMMERCIAL HEAT TREATER!

MTI MASTER CRAFTSMEN METAL TREATING INSTITUTE

American Metal Treatment Co.
Elizabeth, New Jersey

Anderson Steel Treating Co.
Detroit, Michigan

B. & W. Precision Heat Treating Co.
Kitchener, Ontario, Canada

Benedict-Miller, Inc.
Lyndhurst, New Jersey

Bennett Heat Treating Co., Inc.
Newark 3, New Jersey

Commercial Metal Treating, Inc.
Bridgeport, Conn.

Cook Heat Treating Co. of Texas
Houston 11, Texas

The Dayton Forging & Heat Treating Co.
Dayton 3, Ohio

Dominy Heat Treating Corp.
Dallas, Texas

Drever Company
Philadelphia 33, Pennsylvania

Greenman Steel Treating Company
Worcester 5, Massachusetts

Fred Heinzelman & Sons
New York 12, New York

Alfred Heller Heat Treating Co.
New York 38, New York

Hollywood Heat Treating Co.
Los Angeles 38, California

L-R Heat Treating Company
Newark, New Jersey

The Lakeside Steel Improvement Co.
Cleveland 14, Ohio

Metallurgical, Inc.
Minneapolis 14, Minnesota

Metallurgical, Inc.
Kansas City 8, Missouri

Matlab Company
Philadelphia 18, Pennsylvania

New England Metallurgical Corp.
South Boston 27, Massachusetts

Paulo Products Company
St. Louis 10, Missouri

Pittsburgh Commercial Heat Treating Co.
Pittsburgh 1, Pennsylvania

The Queen City Steel Treating Co.
Cincinnati 25, Ohio

J. W. Rex Company
Lansdale, Pennsylvania

Stanley P. Rockwell Company
Hartford 12, Connecticut

C. U. Scott & Son, Inc.
(Stainless Steels)
Rock Island, Illinois

Standard Steel Treating Co.
Detroit 10, Michigan

Syracuse Heat Treating Corp.
Syracuse, New York

Winton Heat Treating Company
Cleveland 14, Ohio

BLISS HIGH PRODUCTION PRESSES "do-it-themselves" at Black and Decker

Just three Bliss High Production Presses produce the millions of motor laminations Black and Decker uses in its complete line of more than 150 portable power tools!

Running in the upper speed range, sometimes at well above 250 strokes per minute, through two shifts a day—and occasionally three. And they've been doing it for a long time now with no problems.

Of course, H-P presses are built for speed. Extra heavy cast Meehanite frame • *Square* gibbing • Automatic lubrication • Variable speed drive • Special air friction clutch • Counterbalanced crankshaft. Every feature has been especially designed to maintain precision at top speeds. That adds up to top production rates, longer die life.

Another plus, users tell us, is the wide open die area that makes quick set-up and changeover possible. In fact, the fast set-up makes *short-run* work practical with Bliss H-P Presses. And the room *under* the press is a handy place to run chutes or store tote boxes.

If production of short-stroke stamped parts is your problem, long run or short, you'll want to learn more about Bliss H-P presses. Our recently revised 32-page catalog No. 27-C describes the entire line and gives examples of the wide range of work you can accomplish with these presses. Why not write for a copy today.

BLISS SINCE 1857

is more than a name... it's a guarantee

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, California; *Branch Offices* in Boston, Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

E. W. BLISS COMPANY, CANTON, OHIO • Presses, Rolling Mills, Rolls, Special Machinery

Look for

IDEAL

GOLD BAND

LIVE CENTERS

GUARANTEED TO MATCH, OR EXCEED, "CRITICAL" JOB SPECIFICATIONS

The key to the ultra accuracy of each Ideal Live Center lies in the use of finest precision machined ball and/or roller bearings. Cap is sealed to keep grease in, dirt out. All parts are hardened and precision ground for maximum performance and accuracy in lathe use.

Requirements vary from job to job, plant to plant. That's why Ideal makes and stocks over 40 different live center styles and sizes. No matter what your job may be, Ideal has a center to fill your needs exactly. In those rare cases where a "standard" unit won't do, we'll tailor "specials" to your specifications. In 99 out of 100 cases Ideal's Gold Band Live Centers will deliver custom quality performance at production prices.

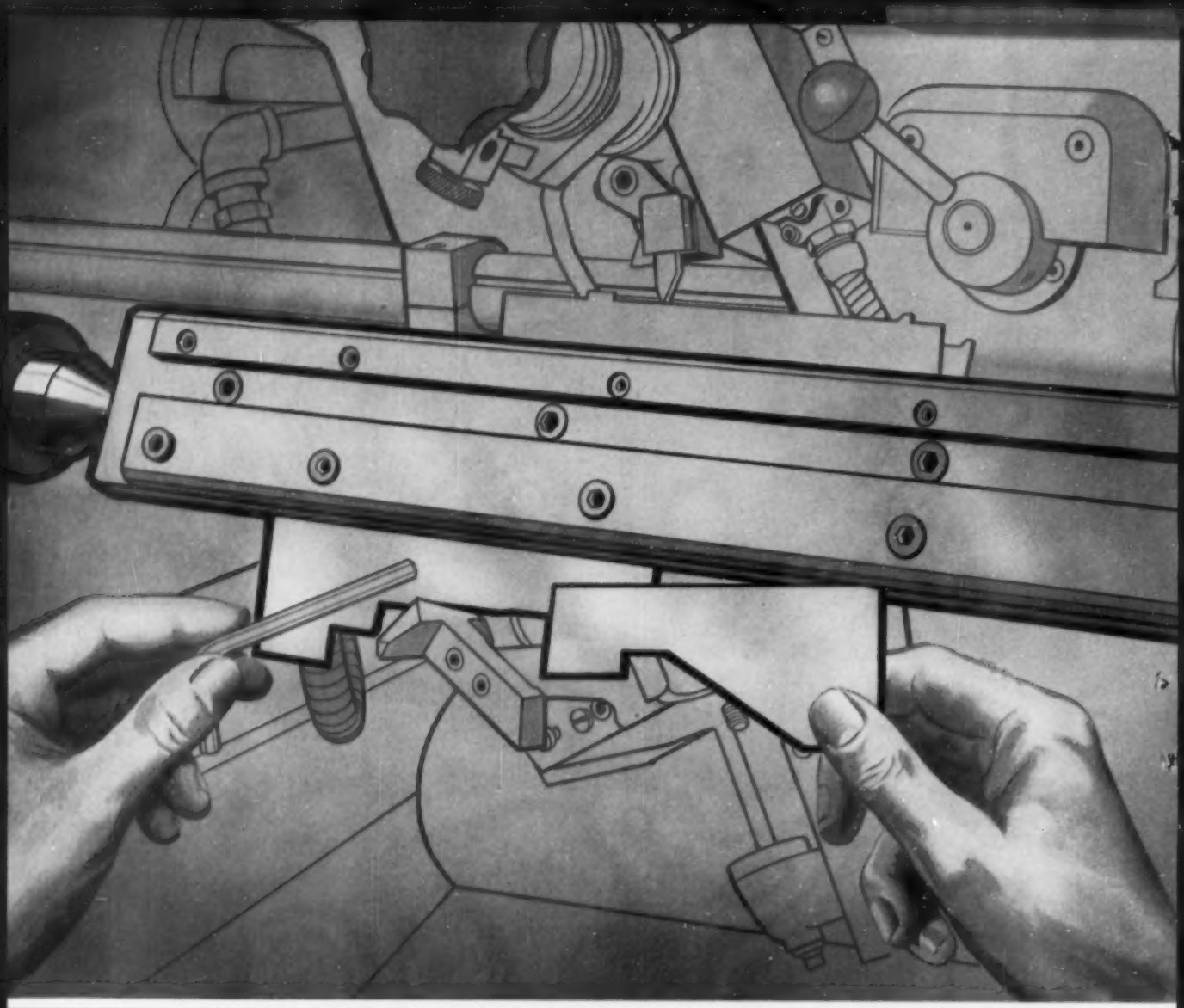
Ideal Live Centers are stocked by leading industrial distributors. Look for the one in your area, or, write directly to us. In either case, you're assured prompt service and satisfaction.

A COMPLETE LINE FOR EVERY NEED . . . SPECIALS TOO!

Send for
Complete catalog data & specifications, today!

IDEAL INDUSTRIES, Inc.
4152-D Park Avenue, Sycamore, Ill.

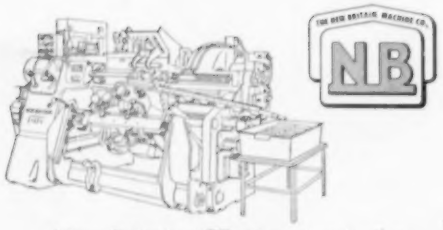
Name_____
Company_____
Address_____
City_____ Zone___ State_____



template control "locks in your dimensions"

on New Britain +GF+ copying lathes

When you fasten the template on a New Britain +GF+ you lock in every dimension of the piece. The complex settings necessary in gang tooling setups simply don't exist. You change the tool in the time it takes to loosen one set screw. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



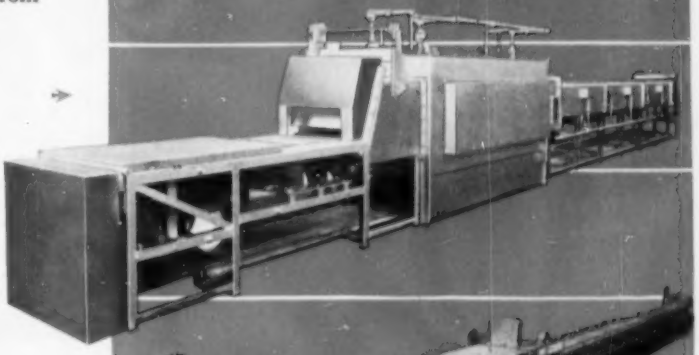
New Britain +GF+ Copying Lathe

Look to Lindberg for Sintering Furnaces

For sintering furnaces, just as in all types of industrial heating equipment, you can depend on Lindberg's ability to supply exactly the right equipment for your needs. Here are some typical Lindberg sintering furnaces:

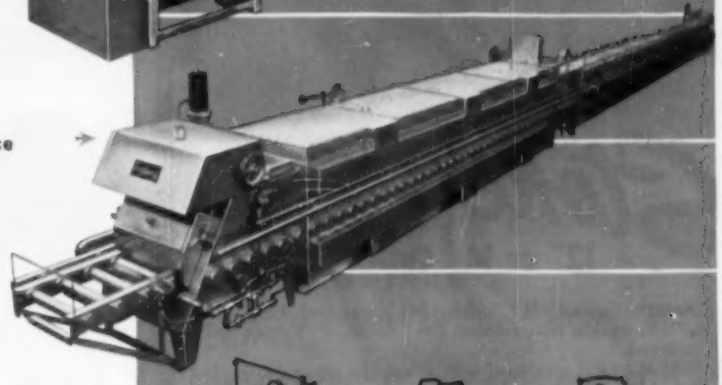
This Hand Pusher Batch Type Furnace

is used for small production lots and experimental sintering. It is an all-purpose unit for operation from 1300°F to 2500°F. Made in various sizes for sintering from 25 to 300 pounds per hour.



This Mesh Belt Continuous Type Furnace

is a popular sintering furnace for small light parts in copper, bronze, brass or steel with a temperature range from 1300°F. to 2100°F. It can be used for low temperature silver brazing, bright annealing, as well as sintering of powder metals. Production ranges up to 500 pounds per hour.



This Roller Hearth Continuous Type Furnace

is especially designed to handle heavier loads up to 2200 pounds per hour. It has an effective temperature range from 1300°F. to 2100°F. It can be used for bright annealing, low temperature silver brazing as well as sintering of powder metals.

Atmosphere Generators

To obtain the best work from any sintering furnaces, the proper atmosphere is required. The atmosphere generators described here provide the proper atmospheres recommended for use with Lindberg Sintering Furnaces.

1. The HYEX Generator produces atmosphere composed of approximately 4% carbon dioxide—18% hydrogen—12% carbon monoxide and 66% nitrogen.
2. The HYEN Generator produces a neutral atmosphere composed of approximately 21% carbon monoxide—40% hydrogen—38% nitrogen and 1% methane.
3. The HYAM Generator produces atmosphere composed of approximately 75% hydrogen and 25% nitrogen.

If you have a sintering or brazing problem why not talk it over with Lindberg. Just get in touch with your nearest Lindberg Field Representative or write us direct.

LINDBERG

ENGINEERING COMPANY

Los Angeles Plant: 11937 S. Regentview Ave., at Downey, Cal.

2447 W. HUBBARD ST., CHICAGO 12, ILL.

STONE cut-off machines do a better job FASTER and CLEANER at Lower Cost

Stone
12" or 14" Cut-Off Machine

CAPACITY: Ferrous, ½" Solids, 2½" Standard Pipe and 2¼" Structurals. Non-Ferrous, 2½" Solids, 3" Tubing and Extrusions.

MODEL M-35A is equipped with a quickly adjustable positive-locking swivel head for cutting up to 45° in either direction, providing superior operation at a lower original cost than any other comparable machine. Positive geared-in-head drive delivers all of its power to cutting wheel. The machine is designed and built to give you long, trouble-free service under the most rugged conditions. Adaptable for wet cutting.

MODEL M-35B (12" or 14" Cut-Off Machine) has same capacity as Model M-35A. Straight edges adjustable for 90° or 45° cutting. Adaptable for wet cutting.

MODEL M-35 (12" Cut-Off Machine) for 90° cutting has same capacity as Model M-35A.

Power stroke of cutting head and other optional equipment available for all of above. All three machines cut at a rate of less than 4 seconds per square inch, leaving a mill-like finish.

For specifications, optional equipment and costs, write to:

Stone Machines are represented in every major industry throughout the world.

STONE MACHINERY CO., INC. 31 Fayette Street Manlius, N.Y.

USE READER SERVICE CARD; INDICATE A-4-318-1

HIGH SPEED LOW COST

Columbia 500 Shaper

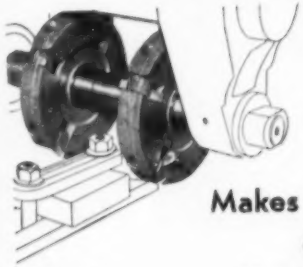
1. 20" Shaper type Columbia 500 has 25" traverse capacity.
2. For precision and high production.
3. 8 Variable speeds.
4. Tool head automatically feeds in vertical direction.
5. Automatic pre-selected shut-off.

$2,680.00

Write for descriptive literature.

Columbia INTERNATIONAL Corp.
10-35 44th DRIVE, LONG ISLAND CITY, N. Y.

USE READER SERVICE CARD; INDICATE A-4-318-2



Straddle milling with New-Field cutter

New-Field
UNIVERSAL FLY CUTTER

Makes 4-6 cuts in one operation!

Uses standard bits!

These are only a few of the many different types of cuts possible with a New-Field Universal Fly Cutter.

No need now for special cutters for many types of milling if you use the New-Field Universal Fly Cutter. One New-Field cutter using any type of high speed steel or carbide bits makes multiple cuts in one operation. Standard bits are easily reground or replaced when needed for other work. Down time is cut to minimum.

New-Field Cutters fit all standard arbors on horizontal or vertical mills or drill presses, turn to any required speed, have adjustable bits to permit slots of any shape from 3/16" to 2" for fly cutting. Available in 4", 6", 8" and 10" sizes, also 6" and 8" heavy duty size designed especially for Shell End Mill Arbors. Write today for details on this versatile, money-saving tool!

TERRITORIES OPEN FOR REPRESENTATION

NEW-FIELD MACHINED PARTS CO.
210 W. 7th St., Los Angeles 14, Calif.

USE READER SERVICE CARD; INDICATE A-4-318-3

R-J automatic needle bearing assembly machine.
Rated capacity: 900 assemblies per hour.

The assembly shown is used in the cross-arm bearings for automotive universal joints.

CASE HISTORY
MACHINE NO. 1237

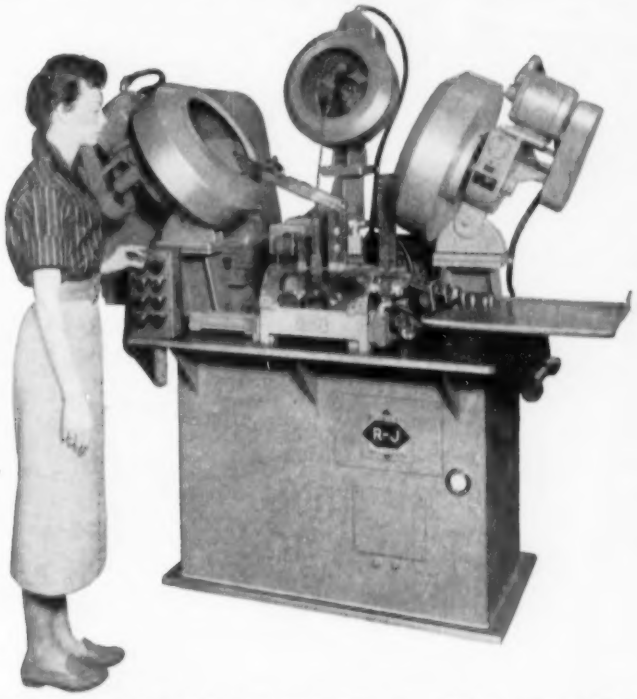
REHNBERG-JACOBSON

NEEDLES

CUP

RUBBER GROMMET

ASSEMBLY



DEVELOPS, PRODUCES, AND DELIVERS ON TIME

PRODUCTION and DELIVERY SCHEDULE

Order Placed	10-5-56
Required Delivery	5-1-57
Engineering Completed	11-30-56
Machining Completed	1-25-57
Sub-assemblies Completed	2-8-57
Final Assembly Completed	2-22-57
Final Testing Completed	2-27-57
Machines Shipped—one	2-28-57
one	3-5-57
one	3-7-57

REQUIRED:

1. A sure way to feed and load 21,000 needles per hour, .093 dia. x .416 long.

2. A reliable mechanism for properly handling and pressing in place a soft "rubber" grommet.

3. Both cup and grommet to be oriented from their hoppers into their feeder chutes, with safety sensors to catch any defective parts that chance to get past orienters.

4. A film of lubricating grease to go into the assembly before the grommet is pressed on.

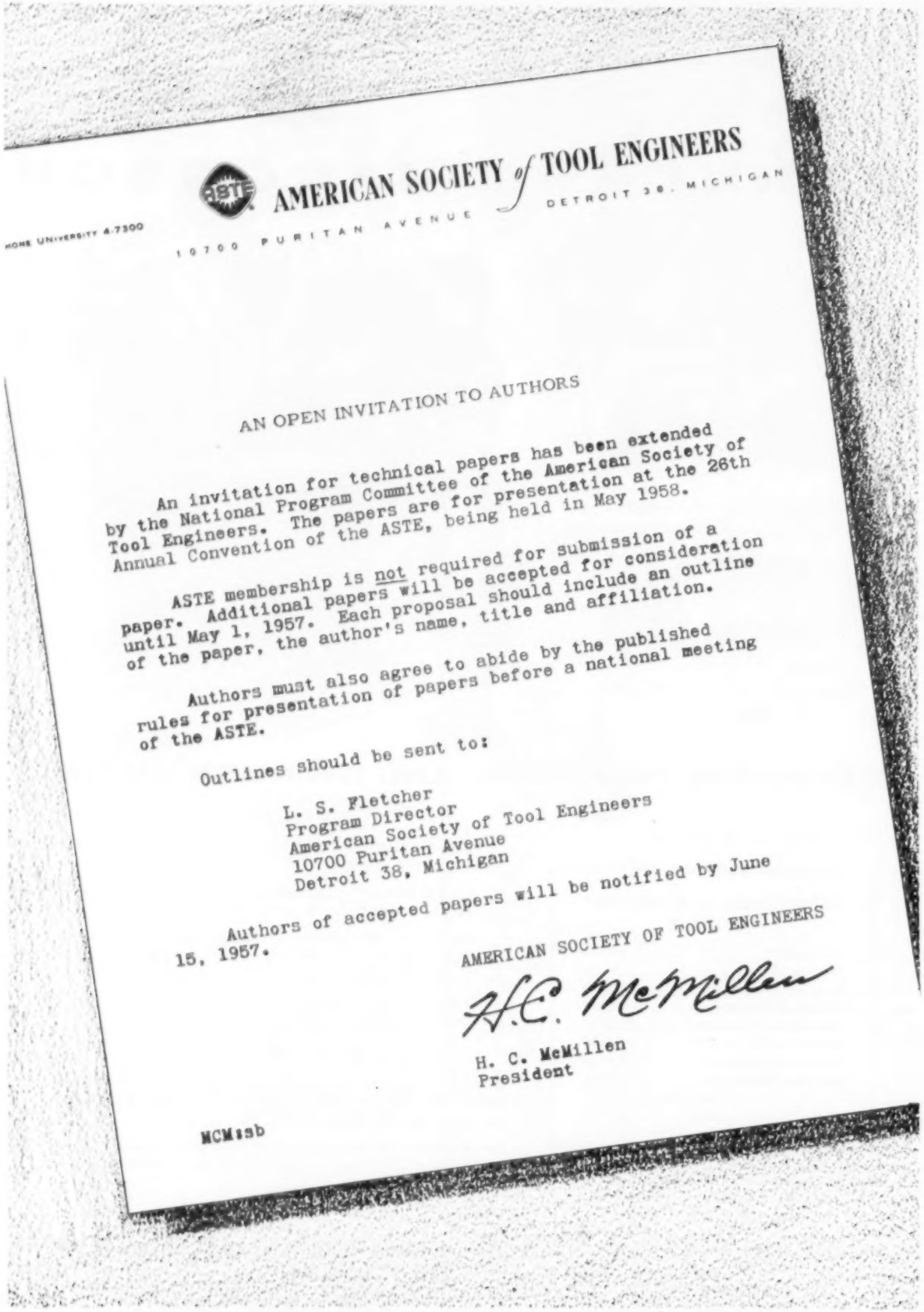
R-J ACTION:

The R-J team did its part by developing, producing, and delivering the machines eight weeks ahead of schedule, as shown by the dates at the left.

For prompt, efficient solution of your production problems, write, wire or phone Irving G. Jacobson, Sales Manager. Telephone: Rockford, 8-2461.

REHNBERG-JACOBSON MANUFACTURING CO., 2135 KISHWAUKEE ST., ROCKFORD, ILLINOIS

DESIGNING ENGINEERS, MANUFACTURERS, AND PRODUCTION CONSULTANTS



AMERICAN SOCIETY of TOOL ENGINEERS

10700 PURITAN AVENUE DETROIT 38, MICHIGAN

HOME UNIVERSITY 4-7300

AN OPEN INVITATION TO AUTHORS

An invitation for technical papers has been extended by the National Program Committee of the American Society of Tool Engineers. The papers are for presentation at the 26th Annual Convention of the ASTE, being held in May 1958.

ASTE membership is not required for submission of a paper. Additional papers will be accepted for consideration until May 1, 1957. Each proposal should include an outline of the paper, the author's name, title and affiliation.

Authors must also agree to abide by the published rules for presentation of papers before a national meeting of the ASTE.

Outlines should be sent to:

L. S. Fletcher
Program Director
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

Authors of accepted papers will be notified by June 15, 1957.

AMERICAN SOCIETY OF TOOL ENGINEERS

H. C. McMillen

H. C. McMillen
President

MCM:sb

Index of THE TOOL ENGINEER Advertisers

April 1957 Issue

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in 1956 ASTE Industrial Exposition

♦Subscriber to ASTE Data Sheet Service

A

*Aaron Machinery Co. ... 312
Accurate Gear Co. ... 168
*Ace Drill Corp. ... 172
*Acme Tool Co. ... 300
*Adamas Carbide Corp. ... 281
*Adcock & Shipley, Inc. ... 296
Air-Mite Devices, Inc. ... 268
Air Transport Equipment Co., Inc. ... 300
*Air-Vacuum Division, F. J. Littell Machine Co. ... 195
Alina Corp. ... 202
*Allegheny Ludlum Steel Corp. ... 26
*Allied Products Corp., Richard Brothers Punch Division ... 162
*Almco Division, Queen Stove Works, Inc. ... 236
*American Brake Shoe Co., Denison Engineering Division ... 244
American Broach & Machine Co., Division of Sundstrand Machine Tool Co. ... 234-235
♦*American Drill Bushing Co. ... 17
American Society of Tool Engineers ... 320
American Tool Works Co., The ... 12
♦*Ames, B. C., Co. ... 226
*Ampco Metal, Inc. ... 66
*Anderson, F. E., Oil Co. ... 173
*Apex Tool & Cutter Co. ... 282
Armstrong-Blum Mfg. Co. ... 159
*Armstrong Bros. Mfg. Co. ... 212
Associated Spring Corp. ... 265
*Atlas Press Co., Clausing Division ... 248
Automation Devices, Inc., Vibratory Feeder Co., Division ... 238
Avey Drilling Machine Co. ... 40-41

B

♦ Baker Brothers, Inc. ... 223
Balas Collet Mfg. Co. ... 324
Barber-Colman Co. ... 62-63
Bath, John, Co., Inc. ... 295
Bay State Tap & Die Co. ... 250
Behr-Manning Corp. ... 299
Bellows Co., The ... 277
*Besly-Welles Corp. ... 298
Bethlehem Steel Corp. ... 49
*Blake, Edward, Co., Inc. ... 268
Blanchard Machine Co., The ... 52
*Bliss, E. W., Co. ... 314
Bodine Corp., The ... 273
Borg-Warner Corp., Rockford Clutch Division ... 214
Boston Gear Works ... 287
*Bristol Co., The ... 268
*Brown & Sharpe Mfg. Co. ... 301
*Bryant Gage & Spindle Division, Bryant Chucking Grinder Co. ... 189

C

Carborundum Co., The ... 42, 261-262
*Carborundum Co., The Stupakoff Division ... 308
Card, S. W., Division, Union Twist Drill Co. ... 51
Carlton Machine Tool Co., The ... 39
*Carpenter Steel Co., The ... 292
Casalbi Co., Globe Division ... 258
*Challenge Machinery Co. ... 275
Chance Vought Aircraft, Inc. ... 284
*Chicago Rivet & Machine Co. ... 217
Cincinnati Grinders, Inc. ... 239
*Cincinnati Milling Machine Co., Flamatic and Inductron Division ... 231
Cincinnati Milling Machine Co., Heald Machine Co., Subsidiary ... Inside Front Cover
Circular Tool Co., The ... 211
*Clausing Division, The Atlas Press Co. ... 248
*Cleveland Grinding Machine Co. ... 158
*Columbia International Corp. ... 318
Columbia Tool Steel Co. ... 279
Composite Forgings, Inc. ... 238
Comtor Co. ... 312
Cone Automatic Machine Co. ... 242
Continental Tool Works Division, Ex-Cell-O Corp. ... 245
Cosa Corp. ... 210
Cross Co., The ... 28-29
*Crucible Steel Company of America ... 10

D

*Danly Machine Specialties, Inc. ... 293
Deakin, J. Arthur, & Son ... 268
Dearborn Gage Co., Ellstrom Standards Division ... 228
*Denison Engineering Division, American Brake Shoe Co. ... 244
*Detroit Reamer & Tool Co. ... 225
*Detroit Stamping Co. ... 276
*Devcon, Inc. ... 206
*DeVlieg Microbore Division, DeVlieg Machine Co. ... 27
Dickerman, H. E., Mfg. Co. ... 200
Die Techniques Publishers Division, Falcon Engineering Co. ... 290
*DoALL Co. ... 307
*Dow Chemical Co., The ... 291
*Dumore Co., The ... 56
Dykem Co., The ... 300

E

Eastern Machine Screw Corp., The ... 202
*Eastman Kodak Co. ... 45
*Eclipse Counterbore Co. ... 204
Elgin National Watch Co. ... 37
Ellstrom Standards Division, Dearborn Gage Co. ... 228
*Elox Corporation of Michigan ... 274
Ex-Cell-O Corp. ... 43, Inside Back Cover
Ex-Cell-O Corp., Continental Tool Works Division ... 245

F

Falcon Engineering Co., Die Techniques Publishers, Division ... 290
*Federal Products Corp. ... 14-15
*Flick-Reedy Corp., Miller Fluid Power Division ... 246
Fonda, D. C., Gage Co. ... 164
Foote-Burt Co., The ... 240

G

*Gaertner Scientific Corp. ... 161
*Galland-Henning Mfg. Co., Nopak Division ... 60
*Gammons-Hoaglund Co. ... 258
♦ Gardner-Denver Corp., Keller Tool Division ... 38
General American Transportation Corp., Parker-Kalon Corp., Division ... 247
*General Electric Co., Metallurgical Products Dept. ... 208, 270-271
Gisholt Machine Co. ... 22-23
Glenzer, J. C., Co. ... 252
Globe Division, Casalbi Co. ... 258
Goddard & Goddard ... 216
Greenfield Tap & Die Corp., Geometric Tool Co., Division ... 36
♦*Greenfield Tap & Die Corp., Horton Chuck Division ... 35

Greenlee Bros. & Co. 57
*Greist Mfg. Co. 182
Grob, Inc. 290

H

*Hannifin Corp. 34
*Hanson-Whitney Division,
The Whitney Chain Co. 175
*Hardinge Brothers, Inc. 5
Hartford Special Machinery Co. 55
Heald Machine Co., Subsidiary,
Cincinnati Milling Machine Co. .....Inside Front Cover
*Heller Tool Co., Subsidiary,
Simonds Saw & Steel Co. 32-33
Hoggson & Pettis Mfg. Co. 238
♦*Horton Chuck Division,
Greenfield Tap & Die Corp. 35
Hy-Pro Tool Co. 156

I

*Ideal Industries, Inc. 315
*Ingersoll-Rand Co. 196-197

J

Jacobs Mfg. Co. 58-59
Jahn, B., Mfg. Co., The 194
*Jarvis Corp., The 213
Jessop Steel Co. 243
*Jones & Lamson Machine Co. 288

K

Kaufman Mfg. Co. 276
Kearney & Trecker Corp. 166-167
♦ Keller Tool Division,
Gardner-Denver Corp. 38
*Kennametal, Inc. 302
King Tester Corp. 282
Kingsbury Machine Tool Co. 16
Knight, W. B., Machinery Co. 191

L

*Landis Machine Co. 8
Lapointe Machine Tool Co. 180
*Latrobe Steel Co. 283
Lavallee & Ide, Inc. 179
*Lee, K. O., Co. 286
Leland-Gifford Co. 272
Lepel High Frequency Laboratories, Inc. 188
Lincoln Electric Co. 289
*Lindberg Engineering Co. 317
*Littell, F. J., Machine Co.,
Air-Vacuum Division 195
*Lodding, Inc. 174
*Logansport Machine Co., Inc. 253
*Lufkin Rule Co., The 205

M

Macklin Co. 249
*Madison-Faessler Tool Co. 44
*Mall Tool Co., Division
Remington Arms Co., Inc. 9
*Matthews, Jas. H., & Co. 290
*McCrosky Tool Corp. 176
Melin Tool Co., Inc. 227
*Metal Carbides Corp. 296
Metal Treating Institute 313
*Metallurgical Products Department,
General Electric Corp. 208, 270-271
♦ Meyers, W. F., Co. 252
♦*Micrometrical Mfg. Co. 203
Middlestadt Machine Co. 290
*Milford Rivet & Machine Co. 183
*Miller Fluid Power Division,
Flick-Reedy Corp. 246
Morris, Robert E., Co. 160
Morse Twist Drill & Machine Co.,
Subsidiary Van Norman Industries, Inc. 24-25
*Motch & Merryweather Machinery Co., The 19

N

National Acme Co., The .....Back Cover
National Automatic Tool Co., Inc. 251
*National Broach & Machine Co. 263
National Tool & Die Manufacturers Association 294
National Twist Drill & Tool Co. 6-7
Nebel Mach. Co.
Smith & Mill Division 323
*Nelco Tool Co., Inc. 207
New Britain Machine Co., The 316
New-Field Machined Parts Co. 318
*New Hermes Engraving Co. 168
*New York Belting & Packing Co. 297
*Nopak Division,
Galland-Henning Co. 60
*Norgren, C. A., Co. 280
Norton Co.,
Machine Division 20-21

O

*Oakite Products, Inc. 190
*Ohio Crankshaft Co., Inc. 68
Olofsson Corp. 255
*Optical Gaging Products, Inc. 222
♦*Ortman-Miller Machine Co. 184
*Osborn Mfg. Co. 264

P

*Pangborn Corp. 258
Parker-Kalon Corp., Division,
General American Transportation Corp. 247
Parkwood Laminates, Inc. 276
Penn Eng. & Mfg. Corp. 193
Pioneer Aluminum, Inc. 198
Pipe Machinery Co. 285
Pope Machinery Corp. 11
Pratt & Whitney Co., Inc 186-187
*Putnam Tool Co., The 309

Q

*Queen Stove Works, Inc.,
Almco Division 236

R

*R and L Tools, Inc. 13
Reed Rolled Thread Die Co. 201
Rehnberg-Jacobson Co. 319
*Remington Arms Co.,
Mall Tool Co., Division 9
*Richard Brothers Punch Division,
Allied Products Corp. 162
Rite-O Tool & Gage Co. 206
*Rivett Lathe & Grinder Co., Inc. 48
Rockford Clutch Division,
Borg-Warner Corp. 214
*Rockwell Mfg. Co.,
Walker-Turner Division 269
Roto-Finish Co. 193
*Rotor Tool Co., The 218
♦ Royco Tap & Tool Co. 312
*Russell, Holbrook & Henderson, Inc. 311
*Ryerson, Jos. T., & Son, Inc. 70

S

♦ S & E Machine Products, Inc. 181
Sandia Corp. 282
Scherr, Geo., Co. 304
*Schrader's, A., Son 303
*Service Machine Co. 252
Sheffield Corp., The 67
*Sheldon Machine Co. 169
*Sheppard, Stanley,
Representative for Adcock & Shipley, Inc. 296
*Simonds Abrasive Co. 241
*Simonds Saw & Steel Co. 170
*Simonds Saw & Steel Co.,
Heller Tool Co., Subsidiary 32-33
*Simplex Corp. 256
Sinclair Refining Co. 61
Smith & Mill Division, Nebel Machine Co. 323
Sossner Tap & Tool Co. 229
*Standard Gage Co., Inc. 4
Standard-Modern Tool Co., Ltd. 18
*Standard Parts Co. 215
*Standard Pressed Steel Co. 254
Standard Tool Co. 257
♦*Starrett, L. S., Co., The 259
*Stone Machinery Co. 318
*Stupakoff Division,
Carborundum Co., The 308
Sun Oil Co. 2
Sundstrand Machine Tool Co. 232-233

Sundstrand Machine Tool Co.,
American Broach & Machine Co., Division....234-235
*Super Tool Co., Subsidiary,
Van Norman Industries, Inc.... 305
*Superior Hone Corp.... 300
*Superior Pneumatic & Mfg., Inc.... 308
*Syntron Co. 224

T

Thompson Grinder Co. 46-47
*Torrington Co., The.... 260
*Twentieth Century Mfg. Co.... 220

U

Union Twist Drill Co.,
S. W. Card Division.... 51
Union Division 50
U. S. Drill Head Co.... 278
*U. S. Rubber Co.... 267

V

Vaill Engineering Co. 304
*Van Norman Industries, Inc.,
Morse Twist Drill & Machine Co., Subsidiary....24-25
Super Tool Co., Subsidiary....305
*Vanadium-Alloys Steel Co.... 237
*Vascoloy-Ramet Mfg. Corp....64-65
Verson AllSteel Press Co. 310
Vibratory Feeder Co., Division,
Automation Devices, Inc.... 238
*Vulcan Tool Co....230, 304

W

*Waldes Kohinoor, Inc.... 221
Walker, O. S., Co., Inc.... 165
*Walker-Turner Division,
Rockwell Mfg. Co.... 269
*Warner & Swasey....30-31
Wendt-Sonis Co. 185
*Wesson Co. 53-54
▲*West Point Mfg. Co.... 296
Whistler, S. B., & Sons, Inc.... 286
Whitman & Barnes, Inc....171
*Whitney Chain Co.,
Hanson-Whitney Division 175
*Willey's Carbide Tool Co.... 306
Winter Brothers Division,
National Twist Drill & Tool Co.... 6-7
Woods, S. A., Machine Co.... 226
*Woodworth, N. A., Co....161, 215

Y

Yoder Co., The.... 179

Z

*Zagar, Inc. 192
Ziegler, W. M., Tool Co.... 308

THE TOOL ENGINEER REGIONAL ADVERTISING OFFICES

EASTERN
Austin G. Cragg
Frank Baldwin
400 Madison Ave.
New York 17, N.Y.
PLaza 9-4018

OHIO
Richard E. Cleary
15515 Detroit Ave.
Cleveland 7, Ohio
LAkewood 1-7125

CENTRAL
Clarence T. Etter
R. Alan Cobleigh
10700 Puritan Ave.
Detroit 38, Mich.
UNiversity 4-7300

WESTERN
Stanley F. Girard
Room 217
612 North Michigan Ave.
Chicago 11, Ill.
MIchigan 2-4465

PACIFIC COAST
Robert E. Ahrensdorf
5720 Wilshire Blvd.
Los Angeles 36, Calif.
WEbster 8-3881

"67,000 HOURS of trouble-free service"

Smith & Mills Shapers now available in Heavy Duty Models in 16", 20", 25", 28", 32" and 36" strokes; and Standard Duty Models (above) in 20" and 24" strokes. Ram, bull gear, rocker arm and universal table trunnion made of nodular iron for extra rigidity.

P. R. Mallory & Co., Inc. reports on 6 Smith & Mills Shapers

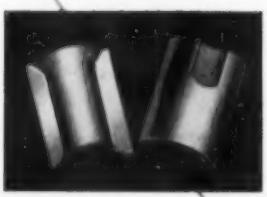
This Indianapolis manufacturer, operating the six Smith & Mills shapers that established the 67,000-hr record of trouble free service . . . has this to say: "Smith & Mills shapers hold very close tolerances . . . offer versatility, speed, ease of operation and quick changeability."

Compare Smith & Mills with any other shaper for versatility, speed, cutting power and precision performance. *Compare* and you'll *buy* Smith & Mills—famous for high quality shapers since 1888.

Write or wire for prices, deliveries, repair parts or field service. Smith & Mills Shaper Div., Nebel Machine Tool Corp. 3411-B Central Parkway, Cincinnati 25, Ohio.

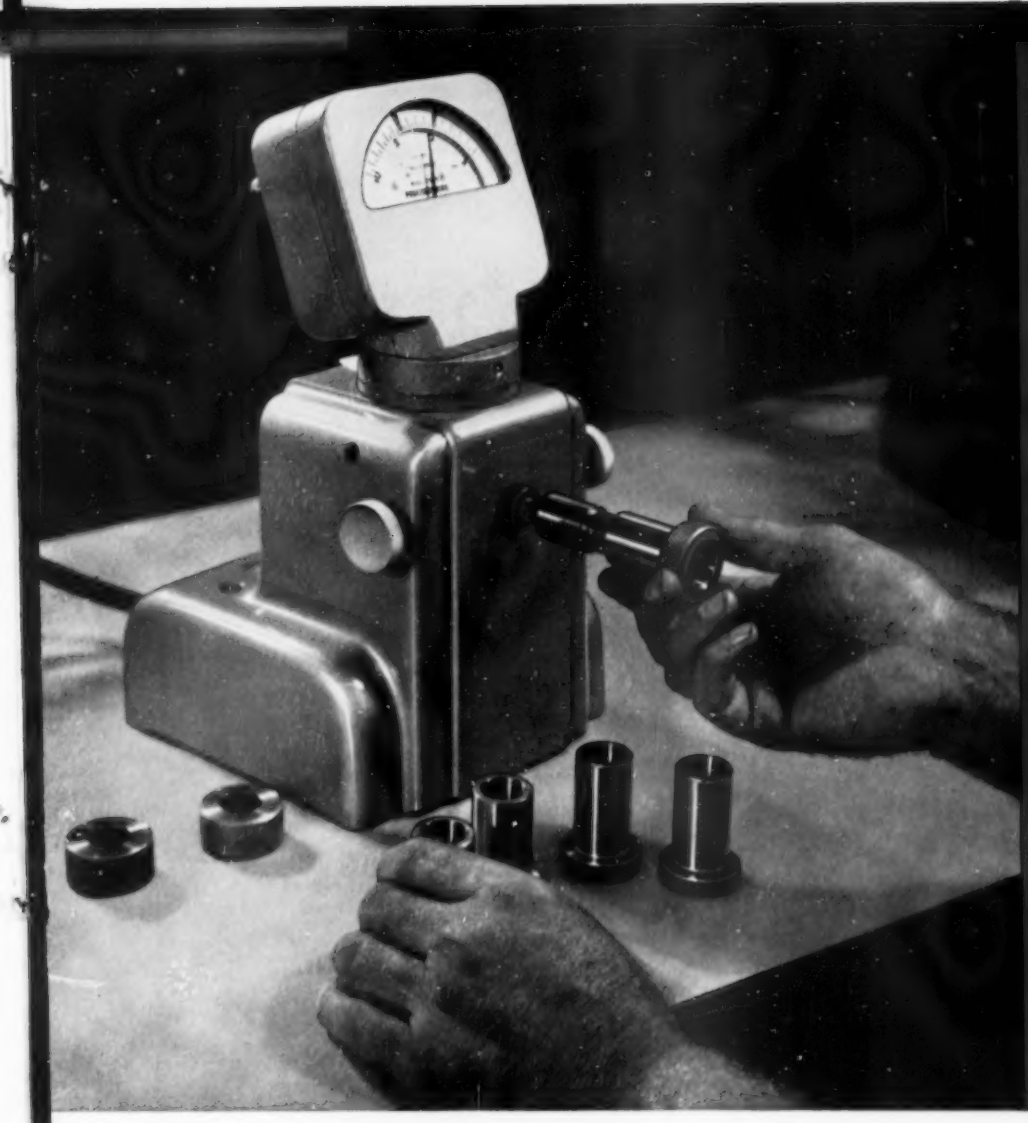
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-323

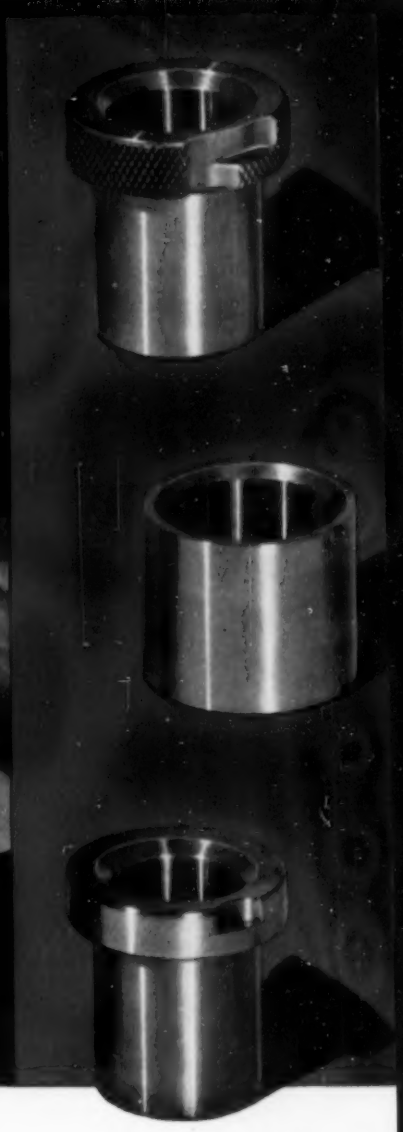
SCREW MACHINE OPERATORS



● To avoid galling and scratching caused by ordinary pusher pads, get the pusher pad that works "like magic"... practically wear proof and relatively inexpensive ...Balas Solid Carbide Pusher Pads for Model "A" Master Pushers! Investigate their exclusive advantages by writing for literature and prices today!

BALAS COLLET MANUFACTURING CO. / CLEVELAND 14, OHIO





EX-CELL-O BUSHINGS LAST TWICE AS LONG

Customer's test proves there IS a difference in bushings

Recently one of the world's largest manufacturers of heavy equipment proved beyond doubt Ex-Cell-O Bushings last twice as long as the other bushings tested. That's good news for all users of bushings! After drilling 16,300 holes, leading bushing brands were measured. Wear on other makes of bushings averaged .0039"—ready for scrap—but wear in Ex-Cell-O Bushings averaged only .0017".

The reasons for this outstanding showing: (1) Ex-Cell-O Bushings are made of high chrome, high carbon oil-hardening bearing steel, (2) automatic atmosphere-controlled heat treating for uniform hardness, (3) precision grinding inside and out, (4) head type bushings and liners are ground under the head for perfect seating.

These bushings take the toughest production runs in stride. Make your own test—see and compare Ex-Cell-O.

Call your Ex-Cell-O Representative or write Ex-Cell-O, Detroit, for the high quality bushings used by major companies all over the world. You'll get "same day" shipment.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

EX-CELL-O FOR PRECISION

XLO

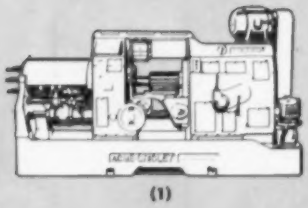
MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-55

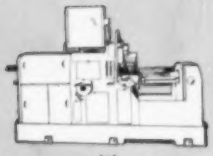
Acme-Gridley...

The World's ONLY COMPLETE LINE

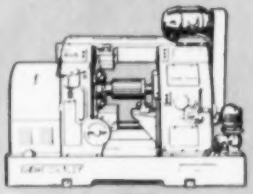
of Single and Multiple Spindle Bar and Chucking Automatics



(1)



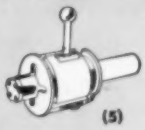
(2)



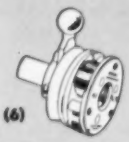
(3)

MACHINERY DIVISION: (1) Bar Automatics—4, 6 and 8 spindle models—22 sizes, in capacities from 7/16" to 7¾". (2) Single Spindle Automatics—Bar Type—4 sizes, in capacities from 3½ to 6"; Chuck Type, 12" capacity. (3) Chucking Automatics—4, 6 and 8 spindle models—8 sizes, in capacities from 5¼ to 12".

(4)



(5)

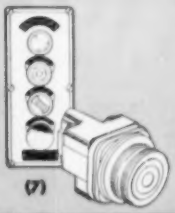


(6)

THREADING TOOLS DIVISION: (4) Vers-a-Tool Self-Opening Die Heads—capacities from 5/16" to 6½". (5) Collapsible Taps—capacities from 1 7/16" to 5". (6) Acme-Fette Self-Opening Thread Rolling Heads—capacities from 1/16" to 2".

Since building the first successful multiple spindle automatic lathe in 1893, the energy and resources of the National Acme Co. have been directed toward the constant improvement and engineering to maturity of these "Master Tools of Industry". How well we have succeeded is gauged not alone by the fact that more automatics bear the NAMCO nameplate *but also by the fact that every automatic bar and chucking machine built today employs the basic principles first perfected in the National Acme prototype.*

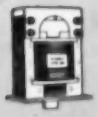
Other National Acme "Firsts" include pioneering circular cutter threading tools to enable mass production thread cutting, introducing self-opening thread rolling heads, and building heavy-duty switches, solenoids and other electrical components—*"Built As A Machine Tool Builder Would Build Them".*



(7)

(8)

(9)



(10)

ELECTRICAL MANUFACTURING DIVISION: (7) Namco GOLD-N-RING—Heavy-duty, oil, water and dust-tight Control Station Switch. (8) Heavy-duty Push Button Switch. (9) Snap-Lock Limit Switch. (10) "Hard-Metal Weld" Solenoid—push or pull to 25 pounds.

National Acme Nameplates Mean SERVICE... Anywhere... Anytime

National Acme

THE NATIONAL ACME COMPANY, 184 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.